

DEMAND SUPPLY LINKAGES IN INDIAN AGRICULTURE AND INDUSTRY SINCE 1961

A

THESIS

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BY

NIRAJ SHUKLA

**UNDER THE SUPERVISION OF
PROF. P. N. MEHROTRA**

(HEAD, DEPARTMENT OF ECONOMICS UNIVERSITY OF ALLAHABAD)



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Preface

The present study has been undertaken with a n veiw to fill the gap which the research in the area of agriculture and industry has experienced so far. That is to say that though lot of research has been done relating to agriculture and industrial sector but the intensive study relating to their linkage or the direction of correlation between the two is still lacking. The forward and backward linkage cofficient have not been attempted in the way as it should have been in the area of intensive cum extensive research relating to the two sectors.

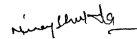
The whole study has been divided into three parts. The first part laid greater emphasis upon the theoretical implication of the two sectors in an isolated way. That is to mean that agricultural and industrial development of India has been attempted therotically and separately.

The second part works out the linkage through between the two and thereby their mutual cooperation and correlated beneficiary pertaining to the development of the two sectors simultaneously and consequently their implication for the development of the economy as a whole. It concentrates mainly upon the terms of trade between the two sectors and thereby their policy implications.

The third part presents an analysis of the backward and forward linkage cofficients and the break up of these. It also studies the input output analysis and the use of one sector as factor input for the other and the output for final consumption. The fourth part presents the summery and conclusion of the whole thesis.

Finally, it will be matter of pleasure to empress thankfulness towards the staff of the Economics Department in general and to my guide Prof. P.N. Mehrotra particularly, who inspite of his busy schedule as provided a lot of time to discuss the most intrication issues relating to my research. I am thankful to Prof. S.N. Lal, Dr. G.C. Tripathi and Dr. U.S. Rai who have provided me with the literature for the above said research topic.

I am also thankful to my colleagues Wamque Anis, Ajeet Tewari, Sanjay Shukla, Vineet Srivastava, Akhilesh Tiwari who have been immensely helping me and encouraging me to submit thesis at the earliest . Above all I can't forget the everlasting help provided by my beloved wife Smt. Vijayshri Shukla.


Niraj Shukla

1.1 Objectives of the study

In a country like India Agriculture forms the basis and dominant part of economic activities. Agricultural sector not only paves the way for setting of industrial base in the economy but also provides essential inputs for the expansion of industrial activities. Indian economy is generally considered an agrarian economy. The process of industrialisation that started after independence has reached a long way showing positive co-relation between agriculture and industrial growth. The objective of the study is to analyse the intersectoral relationship between the two sectors in various ways. In this context, it becomes necessary to find out whether the growth in these sectors and the intersectoral relationships accentuates the process of economic development of the country or not. For this, it is required that agriculture, which provides livelihood to two third population of India, should be undergoing modernisation and its growth should be satisfactory to provide support and stimulus to the development process. On the other hand process of industrialisation should be stepped up so as to cover entire field of economic activities and it should not be confined to few developed pockets of the country. It should take care of available potentials in the form of raw materials and wide spread market. Industrial growth should help the farm sector endeavour for modernisation and growth. Thus the study sets its objects to explore nature and extent of intersectoral relationship. The fact that intersectoral relationship between traditional agriculture and modern industrial sector is bound to be important, assumes greater relevance for a big national economy like India. Moreover this study aims to find out the share of both the sectors in the increased natural menace. It also highlights strong policy measures to strengthen the bonds between agriculture and industry with a view to accelerate the economic development of India.

This study becomes more significant because we observe that agricultural development has undergone a transformation. Today, agriculture depends far more on fertilizers, pesticides, farm machines and tools, processing industries etc., than in the past and such dependence is likely to grow in the future. We have to discover that India can become the largest producer and biggest exporter of agricultural commodities. Our objective is to find out the criteria upon which agriculture may be treated on par with industry. Thus in a developing economy like India, intersectoral and intrasectoral linkage between agriculture and Industry is too much important. In order to put the national economy on rails this interrelationship needs to be understood.

There is a need for better and close collaboration between agriculture and industry. In a country like India, agriculture is predominantly important without which manufacturing ,construction and services sector cannot grow. Agricultural and industrial sectors both are complementary to each other. In fact this complementary relationship weighs more in favour of agriculture therefore, it is primarily in the interest of both these sectors to check the growth and development of one for the other.

The significance of this demand - supply linkage between the two sectors is significant so it because the need to correct the relatively slower progress of the green revolution in respect of the yields and outputs of the food grains . We have to make further researches to analyse how the industry can help in increasing the agricultural income by improving its own efficiency and adoption of better technology which would result in reduction in unit cost of production in industry and lowering the prices of input needed by farmers and ultimately raising their income. We would like to know why the share of agro based industries to the total industrial output is to examine how industry can play an important role in increasing agricultural industry by helping the processing of agricultural products and increasing their exports. Thus agricultural sector influences the industrial sector to the same extent as industrial sector plays a role in the development of agricultural sector.

Lastly we can say than the overall objective of the study is to explore the complexity of intersectoral relationship between the traditional agricultural and modern industrial sector in a dualistic economy. The well defined hypothesis about acceleration of the growth of Indian economy and its Agricultural, Industrial and Tertiary sector, structural change, Terms of Trade and Inter sectorial along with the Intrasectoral linkages will be examined and analysed.

1.2 Hypothesis and Methodology

The inter sectorial relationship between agriculture and industry are of the vital importance for shaping the economic development of a country. The present study proposes to identify various dimensions of sectoral relationship in the economy. The pattern of growth of national income of India may provide a broader idea of sectoral relationship. In the process of economic development modern industrial sector grows more rapidly in comparison to traditional agricultural sector and asserts its influence in the economy. It should be pointed out that the growth of agriculture in a country like India plays a dominant role. Growth in these sectors is reinforced by each other. This is already proved that interaction between the two sector is intensified only when intersectoral transformation takes place and each sector demonstrates growing strength in terms of modernising, production structure etc. To review the role of agricultural sector in economic development following objectives are to be taken into account.

1. Contribution to the overall economic development and the process of structural transformation.
2. Achieving a satisfactory rate of increase in farm output at minimum cost by

encouraging innovation which exploits the possibilities for technical change most appropriate to a country's sector endowments.

3. Achieving a broad base improvement in the welfare of rural population.
4. Facilitating the process of social modernisation in the early years of industrialisation, a large number of consumer goods industries like cotton, textile, leather and furniture etc grew rapidly. But as the process of industrialisation consumer goods, capital goods industries like engineering goods, chemical industries etc. starts dominating the industrial scene to examine the contribution of industrial sector in overall growth rate of the economy. The growth rate of industrial sector as well as segmental growth rate of various industries are to be collected and analysed. To observe the intersectoral relationships between agriculture and industry, the study will take the help of relevant terms of trade analysis using the indices. The calculation of terms of trade is to be based on both terms of trade and gross terms of trade and reasons for difference have to be explained. The time period from 1970-71 to 1995-96 (25 years) has been selected for the purpose of the study. Suitable price deflators will also be used where ever required.

The third base of linkages, taken into account is between agricultural surplus and industrial investment. There seems to be some relationship between the surplus generated in the agricultural sector and the gross industrial investment. The industrial expansion is financed by agricultural surplus in the first phase of development cycle. The surplus generated in the agricultural sector can be estimated by the excess of total agricultural production over the demand for the agricultural products within the agricultural sector. The pattern of growth of industrial investment will be analysed on the basis of data collected from various documents of government of India specially monetary, industry and finance. In addition to the above said data we will also use data from various other sources like previous researches

and student trade union bulletin, Non-governmental organisation and operation research organisation. These data will be collected and property analysed.

1.3 Chapter Planning

The present study will be broadly divided into two sections. Each section consist of three chapters. Besides this, there will be concluding chapter which provides conclusions drawn from the earlier chapter and suggest policy frame work to promote inter sectorial linkages for rapid economic development of the country. In the first section chapter I analyses the various aspect of the inter sectorial relationship between agriculture and industry in the economy. It has also to analyse, how the agricultural sector influenced industrial sector and vice-versa. In the second chapter, the profile of agriculture - industry growth in India during the period 1961 to 1996 will be analysed, with the help of growth pattern of agriculture and industry and hence the overall growth rate of the economy. The intersectoral relationship between agriculture and industry will be estimated and analysed in the third chapter.

The section II also consists of three chapters to estimate the direction and pattern of benefits resulting from trade between agricultural and industrial sector. Intersectoral terms of trade will be thoroughly analysed in chapter IV. In chapter V using input - output test available for the economy, linkage between agriculture and industry will be estimated and analysed. Chapter VI will evaluate the influence of various policy measures of the government for sectoral development of agriculture and industry. In the end, the epilogue is given to update the study so as to make it more valuable.

1.4 Theoretical Underpinning of the Study and Review of Literature.

In a developing economy like India, development dynamics necessitates that the predominant agricultural sector, inspires and in turn is inspired by the expanding industrial sector. Productive activities in such an economy suffers from traditional and compart mentalised mode of production. The relationship between agriculture and industry in the process of economic development has a profound bearing on our understanding of the nature and causes of growth of income and wealth. At a time when the two third of population of the world is facing the problem of poverty, under development and structural change the importance of agriculture-industry relationship can be hardly overemphasised.

History forces us to believe that industrial revolution has always been preceded by agricultural revolution. The development of agricultural sector provide necessary thrust to the process of industrial development. The credit goes to physiocrats who were the first to analyse the interrelationship between agriculture and industry in an economy. They found that agriculture passesses surplus production product not while industry did not possess such potentiality hence industry was said to be sterile. In physiocratic frame work, circulation of wealth was operating. within certain rules given in QUESNAY's "Table on Economique". In Quesnay's analogy, level of industrial employment would depend upon both the level of agricultural investment and the capital intensity of agricultural technology which determine the rate of surplus in agriculture.

In contradiction to physio crats, Adam Smith emphasised upon the specialisation of division of labour which could only be enjoyed in industries. The specialisation and division of labour differentiated industries as well as intensified link between agriculture and industry .It was to the view that a country which successfully develops its indsutrial sector can attain more favourable terms of trade between agricultural and industrial commodities. However

Smith's surplus based approach concluded that agricultural sector retained its particular significance as a supplier of subsistence, food being the major component of wage-goods. In return agriculture received manufactured produce of industries.

Ricardo (1815) observed that the general rate of profit was determined by the farmer's rate of profit in the economy. Ricardo further maintained that in Agriculture extended cultivation along with increasing the rents would also tend to diminish the rate of profit, given the wage.

A general tendency observed in the development process of almost all the economies of the world, is that, there is a growing importance of industrial sector, whereas agriculture loses its prominent position occupied in early phases. Fisher was among the first group of economist who noticed that along with development process, share of agriculture in national income and labour force goes down while that of industry goes up. Because of differences in the sectoral growth pattern in the economy, pattern of sectorial shares in the national income also undergoes a change. The share of manufacturing sector - NDP increases and the share of agricultural produce - NDP decreases, thus manufacturing sector experiences an upward trend whereas the agricultural produce experiences a down ward trend as per their shares in the overall national Income.

In 1691 Sir William Petty observed "... as time goes on and communities become economically more advanced than before the members engaged in Agriculture and allied activities tend to decline in relation to the number of persons engaged in manufacturing and services sector". Colin Clark observes that though the productivity of labour increases in both the sectors, agriculture and industry but the rate of increase of labour productivity is higher in case of manufacturing and services sector.

The most frequently used indicator of economic growth is the change that takes place in an economy's per capita income or more accurately per capita GDP. Prof. Simon

Kuznets is the economist who has used the best and largest quantitative data extending over many years and over many countries. Prof Kuznets has shown conclusively, that there is a positive correlation between the growth of GDP and that of industrial sector in terms of share while it is negative in the case of Agricultural sector. Referring to the sectors it explains a somewhat mixed though positive relationship between the growth of GDP and the rate of growth of tertiary sector in terms of shares. He further says from the experience of the economically developed countries that in the long run decline in the share of agriculture sector was basically due to low income elasticity of demand for its products. Lower elasticity might have been due to a change in the structure of human wants which shifts away “.....toward the products of manufacturing and services sectors as a result of the technological changes and shift in the pattern of work and life.....”.

Scitovsky also says that the industrial activities in under developed economies are pursued for development which invokes external economies for the benefits of other activities in the economy including the traditional sector.

Sukhmoy chakravarty has opined that during mid - eighties, India reached a stage of high level of agricultural production. Nevertheless “the strength of the industry - agriculture linkage seems to have weakened somewhat over three decades of planning”. He explains this change through four major forces which have pulled down the growth stimulating effect of agriculture. First, growth in agriculture has been largely confined to food grains whereas commercial crops, which are needed as industrial raw materials did not register much growth. Secondly purchased inputs in agriculture have exerted pressure on imports. Thirdly, industrial production has been oriented towards highly capital and import intensive consumer durables. Fourthly, the Indian capital goods sector has increasingly faced competition from imports. Therefore he suggests that “possibly more is needed today for a rapid industrialisation than maintaining a satisfactory performance in agriculture, particularly because agriculture itself has become more import dependent than before”. Johnston & Mellor have also devised few criteria to judge the development of agricultural sector. He says, 1, agriculture should be

able to meet the growing requirement of food articles, 2; export of agricultural product should be stepped up for earning foreign exchange in the earlier stages of economic development, 3; It should supply labour force and meet the capital requirement of industrial sector, and 4; Agriculture should raise its cash income to provide ready market to industrial products.

These generalisation about agriculture - Industry inter relationships, in a developing economy are also manifested in the dualistic theories of economic development. Almost all the proponents of structural transformation in developing economies and secular decline of agriculture's relative share in national product have emphasised the changes in the composition of demand with rising per capita income. This is due to the fact that the income elasticity of demand for food products is less than that for industrial products. This is a fact implied by Engel's law.

According to I. J Ahluwalia (Industrial growth in India's stagnation since the mid seventies), change in the manufacturing sector of the Indian economy has been in the right direction with trend for higher importance of the registered manufacturing sector. Registered manufacturing sector recorded a higher growth rate in comparison to non -registered manufacturing sector. However difference between the rate of growth in terms of shares in national income has been reduced from 15 percentage points in 1960-61 to 11.3 percentage points in 1990-91. Thus the tendency of the two sub-sector's seems to match each other. In the Indian economy, it is found that the distribution of the manufacturing sector (value-added) was in favour of the registered sub sector (60 percent) during 1960-70. The unregistered sub -sector contributed lower share (40 percent). Similar constraints is faced even at the state level. For further analysis to meet our purpose it is proposed to analyse rigorously the factor sector.

Earlier economists have tried to evolve the paradigm of development on the basis of the concept of dual economy. On the one hand in case of traditional sector obsolete production

technique was used with over burdened labour, low level of capital utilization and low capital formation. On the other hand in case of industrial sector we depended more on modern techniques of production and used high level of capital stock.

R. Nurkse has given much importance to the level of capital formation and treated disguised unemployment as a potential source of capital formation in underdeveloped economy. Later Arthur Lewis proposed a model for a dualistic economy where upon surplus labour can be with drawn from the subsistence agriculture sector with traditional production techniques. The with drawn labour may be employed at subsistence wage rate in the modern 'capita list' industrial sector. As a consequence surplus would be generated in the indstrial sector and it would be reinvested in the expanding sector using modern production techniques. Thus the indstrial sector emerges as a dominant sector of the national economy. This is also borne by the fact of higher worker's productivity in the manufacturing sector and lower worker's productivity in the agriculture.

With regard to productivity of labour we would like to mention the different census years defining main workers, marginal workers and non-workers. In 1961 economic data were collected on the basis of work. The population was divided into two classes, 'workers' and non-workers'. In the case of regular employment in any trade, profession, service, business or commerce, the criteria of work was satisfied if the person had been employed during any of the 15 days preceding the day on which he was enumerated. In the 1971 census, the main activity of the person was first ascertained according as he spent his time basically as 'worker' producing goods and services or as a 'Non-worker'. A worker was defined as a person whose main activity was participation in any economically productive work. In the 1981 census the whole population was divided into three categories viz. Main workers, marginal workers and non-workers. The main worker was defined as a person whose main activity was participation in any economically productive work by his physical or mental activities and who has worked for 183 days or more. A non-worker was defined as a person who had not done any work at any time. The difference arising out of these classification of

workers besides the differences arising out of the dual reference period mainly make the comparability of workers through various causes difficult. Thus the accurate estimation of worker's productivity in both the sectors - Agriculture and industry, becomes difficult.

Thamarajakshi and chakravarty estimated the lagged influence of the agriculture on industry in the Indian economy Thamarajakshi observed that the influence of Agriculture on the industry was better realised after a gap of one year. Chakravarty showed that between 1970-71 to 1983-84, lagged effect of the agriculture on the industry was stronger unlike the period of 1960-61 to 1969-70. When concurrent influence was found stronger. Thus the over all conclusion of their study was that the economy is gradually moving on the path of development and structural transformation. The fact of structural transformation of the economy is strengthened because of higher trend growth rate shown by the industrial sector whereas it has almost been stagnant for the traditional agricultural sector.

Renies and Fai modified Lewis model and argued that in a dualistic economic development, total saving found is composed of agricultural surplus and Industrial profit. They should be allocated between two sectors in such a manner so that labour productivity may increase and the labour be released in order to create demand for the allocated labour force. Production of Agricultural products and industrial goods should increase in a balanced form. Watanable has demonstrated with the example of Japan's Industrial development that prudent utilization of elastic supply of labour living under completely traditional standards may boost the industrial expansion in a dualistic economy while utilizing capital intensive technology in industrial sector.

The other type of development economists Jorgenson Euke and Sechultz has given much emphasis on the development of agricultural sector. Jorgenson rules out the possibility of zero or negative marginal productivity in agriculture and asserts that it is the agricultural surplus that determines non-farm employment. Schultz also observes that the traditional agriculture in backward countries does not have surplus labour with zero marginal productivity.

He emphasised that the development of Agriculture should be done on priority basis so that it may emerge as a “powerful engine of growth”.

In course of time a large number of economists have questioned the efficacy of neoclassical model of the development in solving the problems of under developed countries. These empirical studies revealed that neo-classical approach worked well in developed countries while it failed to solve the problems and miseries of developing countries. Later even Keynes general theory has been questioned by a number of economists in this regard. Hershman advocated classical approach of development during 1950's. But later, he changed his opinion for neo-classical approach called as neoclassic model of development. He says with regard to “the real wounding of development economics” that neo classical critique made some valid points”. He observed that modern capital intensive industry was found to be less effective in absorbing the unlimited supply of labour available in agriculture than had been the case in the course of earlier experiences of industrialisation.

On the other hand economist like ‘Amartya Sen’ asserts that for development analysis classical approach above is relevant and analysis-oriented. Dandekar also argues that the neo-classical theory is not able to take cognizance - “diversity and differentiation”. In developing economies. This diversity and differentiation is between the capitalistically more developed and less developed sectors. The controversy between classical and neo-classical approach to development analysis seems to be unending and the debate is still going on for a concrete and precise model of development. Chancery successfully come out of this controversy and says that in developing economies, it would be better not to indulge in controversy regarding the superiority of classical or neo-classical approaches to development. Instead, he advocates for the prudent and balanced use of the two approaches in developing economies in order to get the best possible result.

1.5.1 Agriculture - Industry Relationships in International scenario

Empirical studies suggest that there has been positive and strong correlation between the rate of growth of agriculture and industrial development in an economy. Tracing the genesis of industrial revolution in Europe during 1700-1914, Paul Bairoch noted that in European nations it was agriculture which grew first at a rapid rate. It permitted and fostered an unprecedented development of the industrial and mining sectors. He concluded that in a generalised form, industrial development is impossible without a concomitant priority based on development of agriculture.

In modern times Chenaey, applied log-linear regression model to cross - section data for 51 countries. In it the variables like per capita income and population have been taken as independent and explanatory whereas the shares of primary production (agriculture and mining), industry (manufacturing and construction) and services in national income have been taken as dependent variables. He found elasticity of growth in the primary sector very low (0.494) and elasticity of growth in the industrial sector very high (1.362). The share of manufacturing in GNP registered an increase from 17% per capita income level of 100 dollars to 38% at a level of 1000 dollars. The share of primary production declined from 45% to 15% of the total GNP at these respective levels.

The combined effort of Chenery and Tayler, later has come out with more sophisticated modal and widened the scope of the study. Their study provided three types of development pattern. For this, data for 54 countries from the least development to the most developed economies are used for the period 1950-63. The study reveals the fact that the relation between changes in industrial structure and rising per capita income differed substantially among three groups of countries. The selected countries were put into three different groups. First groups consisted of 'larger countries' including India with population

greater than 15 millions. Second group consisted of smaller countries - industry oriented, that is with their trade orientation towards export of manufacturing products. Third group consisted of smaller countries - primary sector - oriented, that is with their trade oriented towards export of primary products. Tayler observed in his study that in the third group the share of the primary production in GNP exceeded upto the income level of 800\$ (at 1960 prices). But in the case of large countries the share of the industry starts rising from 16% of GNP at an income of 100 dollars to 32% of GNP at 400 dollars of per capita income. Thereafter this increasing tendency slowed down. Secondly the share of primary production falls steadily and matches the industrial share of 27% at a level of 280 dollars. This study implies that the balance between industry and primary production is not economical over the medium term.

In the USA and Japan; extensive research has been done in Agriculture - Industry relationship which is of particular relevance to Indian agriculture. Crops in arid places, saline areas etc can be grown profitably. We need to work on dry farming in this country, because today one third out of 180 million hectares of gross cropped areas of our land is draught prone. If we adopt this new technology, agriculture will undergo a second green revolution and totally change the character of our rural economy. Dry farming is the weakest link in the agricultural sector and it is here that a breakthrough is needed for increasing production and distribution in the years ahead

Kirti.s. Parikh in his study entitled as “the strategies for agricultural liberalisation ; consequences for growth, welfare and distribution”, point out that in commodities where India has market power, the non-linearity in world prices in response to India’s trade of the commodity should be accommodated, for example in the case of rice. He says that if India were to export rice freely, the world market price of rice is likely to fall. A correct measure of disprotection of rice would be the difference between present domestic price and the world market price that would prevail in India if we want free trade in rice.

Pande observes that Non-agricultural trade liberalisation results in a determination in the average welfare indicators. This is largely due to the fall in equivalent income of the rural rich and whole of urban population due to increase in tax rates on non-agricultural incomes. The equivalent incomes of urban population falls inspite of growth in real non-agricultural GDP because of the terms of trade effects. The result of this study indicates that as rice export rise, domestic rice price increased. The production structure shifts in favour of both rice and wheat and there is a gain in real GDP for optimal tariff policy. We should also analyse GDP effects. For exports beyond 4 million tonnes, the world price falls below the domestic price and it would be in the sense that we forced to export rice when we should be infact importing. The export tariff for rice would be socially optional at a level such that rice exports are around half a million tonne.

In the USA, agriculture employees are only 3 percent of the population. It is only the routine agricultural operations of farming. But over 50 percent of the US population is employed in business, industrial, commercial and all other adjectives which supports agriculture. The US is exporting \$40 billion worth of foodgrains which guarantees growth in packaging, for warding and the growth of shipping and insurance corporations, and so on - This kind of diversification is not taking place in India. There are a number of opportunities, particularly in the field of exports.

While studying the economic development of Japan, Economist like Johnstan and Okhawa have made some peculiar observations. In Japan agricultural output increased without demanding for a share in capital and foreign exchange as well as without changing small holding and land man ratio. Secondly industrial sector advanced more rapidly. Thirdly gains in agricultural productivity resulted in increasing savings and investment rates for industrial expansion. Okhawa studies Japan's economic development during a long period between 1885 to 1961. He further sub divided the total period into three phases. Okhawa observes during the first phase (1885-1919), high rate of outputs. In the second phase (1919-1945) there was slightly higher increase in inputs in agriculture due to low growth of output. But in

the third phase (1945-1961) Japanese agriculture experiences a combination of the highest rate of growth both in inputs and outputs. It shows that in Japan, during the process of economic developments, resources, were not squeezed in agriculture. On the other hand agriculture experienced transfer of capital favourably.

There are two kinds of approaches which have been evolved for the development of agriculture. The first approach favours strengthening of capital stock in the predominant agricultural sector. The second approach suggests that since Agriculture is the basic and dominant activity in a developing economy, it should shoulder the responsibility of supplying resources to the expanding industrial sector in the process of economic development W.F. Owen opined that in the developing economies, the emphasis should be laid, not on the immediate equity between farm and non-farm incomes, but on the maximisation of growth rate in agriculture and maximum immediate diversion of the resulting increment towards the production process and support for emerging non -form sector.

W.H. Nicholls has given much emphasis on increasing agricultural surplus that may become the basis for launching and sustaining economic growth in the near future. For this he also recommends relatively moderate inflow of capital into agricultural sector for raising production. On the other hand, A.O. Krueger opines that a slight adverse terms of trade for agriculture would rather be beneficial if the output is increased and the labour shifts towards the urban industrial sector.

The importance of sectorial interdependence of economic development has been clearly drafted out by Hershman on the basis of backward and forward linkages. Hershman preferred that backward linkages should be strengthened for expanding industrial sector in a backward economy. These concepts of linkages have been proved very useful. These have been intensively applied in input - output technique by development economists Y. Kubo and others have found that there is a positive relationship at the sectoral level between growth of output and the rate of change of use of intermediate inputs. They found that the growing use

of intermediate inputs is associated with an increasingly growing economic system which is characterized by the prevalence of more round about means of production in developed countries.

The developed world, according to an expert, in the next 50 years is likely to increase its population only by 200 million from the present 1.13 billion, it is likely to go in AD 2025 to 1.35 billion. What is happening in these countries is the reduction in wheat consumption. That is why the wheat grain market is going down. Thailand is in difficulty because the Thai oriented their whole export to wheat grains, kasava and so on.

Today, the European Economic community is reducing their agricultural imports; there is a focus on animal produce and health consciousness has now become so great that most of the people are becoming cautious. There is a great demand for salad vegetables. Unless India takes note of the foods of the future, and the emerging food baskets, she will lag behind in terms of imports of foodgrains without an innovative approach.

Various policy scenarios have been developed to analyse the effects of trade liberalisation, optimal rice export quotas/moderate productive tariffs, capital influxes, agricultural inputs subsidy, removal and safety net programmes N.S.S. Narayana points out that trade liberalisation helps to accelerate economic growth in the medium run by increasing allocative efficiency with in agricultural sector and between agricultural and non-agricultural sector and by increasing real investment due to terms of trade effect. He observes that the influence of increase in investment is much stronger than that of allocative efficiency. The potential gains due to better allocative efficiency with in non-agricultural sector as also within some of the commodity groups are not captured in the model in its present form. Subject to these limitations it is concluded that investment goods liberalisation has a greater inputs on growth, even agricultural growth than agricultural liberalisation.

A Ganesh Kumar in his study "strategies for Agricultural liberalisation " analyses that

agricultural trade liberalisation beginning 1994 will result in a growth of 1 percent by the year now in agricultural GDP whereas when non -agricultural sector is also liberalised, agricultural GDP grows by more than 3 percent. The terms of trade moves in favour of agricultural by 27 percent when non agricultural sector is liberalised whereas it is less than 2 percent when only agriculture is liberalised. The terms of trade effects dominate the determination scenario outcomes along with national outcomes. Thus a very important conclusion emerges for Non Agricultural and agricultural trade liberalisation. This also means that the process of liberalisation which has so far only reduced non-agricultural protection cannot be said to have by passed agriculture.

N.S.S. Narayans point out that in the long -run agricultural trade liberalisation leads to high volume of exports of all agricultural goods except coarse grains. Particularly, exports of wheat, rice, dairy products and non-food products could expand substantially. Prices of several agricultural sectors which are disprotected now; would rise with trade liberalisation while prices of industry and some agricultural sectors (course grain and other foods), which are protected now would fall. The only exception to this pattern is the rice, the price of which falls despite prevailing disprotection. He explains this counter - intensive result through the large - country effects and associated export quotas.

1.5.2 Sectoral Relations the Indian Economy

It was only after independence that a planned and systematic development of Indian economy was initiated. At the time of independence economic diversification was too much limited confined only to particular regions, and sections. Agriculture was the dominant economic activity, whereas industrialisation was at a very low level. Therefore the model of economic development, adopted by our planners, stressed for rapid industrialisation and

increasing the growth rate in total production as well as labour and capital productivity. During the process of development, the ratio of per capita income in non-agricultural and agricultural sector has been rising continuously. This highlights the growing importance of non agricultural sector in the economic development of India. Dandekar also observes that the ratio of per capita income in the unorganised non-agricultural sector and agriculture has been lower than the ratio of per capita income in organized non agricultural sector and agricultural sector. Moreover, shift of population towards the unorganized non agricultural sector has been higher than towards the organized non-agricultural sector.

The study of Ghosh and Sen over the period 1950-85 shows that lopsided growth of both agriculture and industry is becoming more pertinent in terms of intersectoral growth as well as intra-sectoral relations. Therefore they have argued that Indian economy has been professing a dualistic pattern of development. The study of Bhattacharya and Mitra has also established this fact at regional level. They observed that there was a great deal of variation between agricultural and industrial growth rates during the 80's at the state level of economies. Moreover, the pattern of industrialisation varies across the states. The industrially developed states depend more on all-India and internal markets for selling industrial output. States with a very low share of consumer goods in total industrial output are less sensitive to demand generated within the states. Among the material producing sectors there are traditionally dominant and slow growing agricultural produce and fast growing relatively modern industrial sector. Such judgements by Ghosh and Sen established the dichotomy between agriculture and industry in Indian Economy. However, Sukhmoy Chakravarty rules out the possibility of Lewis model in Indian Economy. For the Lewis model, wrongly considers modern industrial sector self sufficient in food availability. Modern Industrial sector's dependence on the agricultural sector is due to the latter sector's role as supplier of labour force. He further suggests that analysis of the transformation of Indian economy from traditional to the so called modern form may be elucidated in better form with the help of classical approach towards development analysis. That is, Indian economy may undergo transformation along the classical line.

Federation of Indian chambers of commerce and Industry conducted a small study in terms of statistics. This study revealed that for every 10 per cent rise in agricultural production there is a direct increase of industrial production by 2.5 percent and indirect increase by 4.5 per cent. Therefore there was an altogether increase of industrial production by 7 percent for every 10 percent increase in agricultural production. This shows strong direct relationship between growth of agriculture and industrial production. For developing agriculture on modern lines and for bringing in new technology, new marketing management, new cropping technique, in terms of production and distribution of agricultural products will have to be introduced. But it does not necessarily mean that industry should be allowed to get involved in agricultural production in one form or the other. Nevertheless, there are many ways by which industry could help in increasing the agricultural income of the farmers.

According to some modern economists industries can adopt some of the areas or villages situated around their location and help in the development of infrastructural facilities required for the development of agriculture in these areas. It can also help in transferring the technology to the farmers. As in the case of fertilizers and pesticides, the industry should not only be concerned with the distribution of these inputs but should also undertake training and education of the farmers for the balanced and judicious use of their inputs which would ultimately help in increasing agricultural production and income. The industry can further help in increasing agricultural income by improving its own efficiency and adoption of better technology which would result in reduction in cost of production in industry and lowering the forces of inputs needed by the farmers and ultimately raising their income. Industries can also help in developing and locating new markets for agricultural products. Processing of agricultural products and exports are the areas where industry has an upper role to play in increasing agricultural income. Modern technology in Agriculture is closely associated with the use of fertilizers, pumped water, plant protection and the use of tractors and threshers. This is closely related to the development of the industrial sector.

Leontief input - output technique is suitable for accelerating the interrelationship

between different industries and sectors. Based on this technique, the latest input-output test for Indian Economy shows the dependence of different industries on other sectors. On the basis of these data, the direct requirement from other sectors of the economy for every, Rs one million output of industrial group of industries have been established. This has been estimated on the basis of 'Economic trends' published in 1985. For the manufacturing sector as a whole, farm input account for 36.4 percent of real value inputs of the non - farm inputs, the former accounts for 73.3% and the latter for 22.7%. Agricultural commodities account for 36.8% of all commodity outputs required by the manufacturing sector directly. It also supplies 24.8% percent of the non-farm inputs used by the manufacturing sector.

The extent and the nature of interrelationship between agriculture and industry, in the Indian economy makes it a unique experience. According to Dantewala, Agriculture being the dominant and crucial economic activity, did not suffer from deliberate actions. This view has been neglected during the course of planned development of the economy. But Sukhmay Chakravarty contends that there was a neglect of agricultural ratio. Actually the agriculture was considered as a 'bargain sector' meaning thereby that there is unutilized potential in agriculture which can be explored with small doses of investment.

At a seminar on agricultural development, 'A seminar to economic growth' held on 2nd September 1985 at the Federation of Indian chambers of commerce and industry, the Union Agriculture Minister confirmed the stimulus given by agricultural development to economic growth in India and he proved with the help of empirical evidence that there was a strong relationship between industry and agriculture. In the year when the agricultural production showed decrease, the per capita national product at constant price (1970-71) also declined. The reverse trend happened in the years of increase in agricultural production. For instance in the years 1979-80 when the agricultural production decreased by 16.17% over the previous year, the per capita net national production at constant price (1970-71) also declined by 7.4 percent. Again in 1983-84, agricultural production increased by 17.0 percent over the previous year and the per capita net national product increased by 5.2 percent.

This strong relationship between the agricultural development and economic growth can be ascribed to two factors; the contribution of agriculture of about 40 percent to net domestic product at constant prices, and dependency of secondary and tertiary sector on agriculture. The mutual interdependence between agriculture and industry can be further elaborated. In the first place, the growing need for raw materials in industries and for food by industrial labour can be met only by the agricultural sector. Industrial growth makes feasible greater per capita domestic consumption and greater absorption of agricultural labour force. The transfer of labour from agriculture to the highly productive industrial sector itself becomes a source of economic growth.

It has been estimated by an official committee that the country loses about 10 percent of its total foodgrains production because of poor storage facilities. The food corporation of India (FCI) and the central and state warehousing corporation store almost 30 million tonnes or more when the Kharif crop starts arriving in October, and they have about the capacity for storage of more than two thirds of the volume. Some 10 million tonnes will have to be stored in a raised platform where the grain is stacked and adequately covered with tarpaulins or other moisture resistant covers. As a result of inadequate investment in storage transport and processing the public distribution system routinely sells foodgrains which would normally be considered as unfit for human consumption in most other countries. Thus it is evident that merely increasing production of foodgrains will not solve the problem until and unless it is accompanied by increasing construction of godowns and other storage facilities which comes under secondary sector. This again strengthens the need for close collaboration between agriculture and industry.

During the first three five year plans the economy suffered from shortage of foodgrains. In mid sixties, 'New Agricultural strategy' popularly known as Green revolution has been started. It was observed that the decrease of rate of growth of agricultural outputs during 1960 as compared to 1950s was due to the slowing down of the rate of expansion of cropped areas. Further, after green revolution there has been a significant increase in the

growth rate of agricultural output as a result of application of new technology, HYV seeds and modern inputs. High yielding variety of foodgrains production technology may induce growth linkages in the form of domestic consumption and production linkages with the non-farm sector. However, according to Meir and Late this technology has little impact on employment generation.

Role of agriculture as a supplier of wage goods to the non-farm sector has been widely recognised. In India it has been claimed by Nachave, Sawanah and Achutan that Agriculture exerts influence on economic progress and shortage of wage goods hold up the performance on Industrial sector during the 1970s. Agricultural's role as a supplier of resources to finance the process of industrialisation has also been acknowledged S.L. Sheti has estimated that as proportion of sectoral income, the contribution of farm sector has been lower than the non-farm sector during 1951 to 1968-69. However during the first three plan periods, the tax burden held by the farm sector does not appear to be inadequate as compared with its relative taxable capacity.

On the other hand the non-farm sector had been taxed, lower than its taxable capacity. Later SH. SHAH has again highlighted the fact that there was marginal scope by lessening tax burden on the Indian agriculture in the light of comparatively low average increase and relatively small capacity of farmers for private investment.

Several studies observed that the Indian economy has been facing a declining tendency of investment in the farm sector. According to Shetti, the growth rate of gross capital formation during 1960s was 6.3% per year at 1980-81 prices, which declined to 5.4% during 70s and further turned out to be 2.6% per year during 1980s. However it is found that the cost of agriculture has been rising continuously. According to M.V. Nadkarni the land productivity increased during 1970 to 1985 but through a strategy which is proving to be increasingly costly, reflecting inherently unsustainable character of their productivity. It is because of increasing use of fertilizer, pesticides and diesel, Recently in a study it has been

found that the Indian agriculture has been more import intensive due to excessive use of chemical fertilizers, pesticides and machines having much import constituents.

Meanwhile squeeze on agriculture as a result of adverse terms of trade and concentration of agricultural growth in certain areas has improved ratio of Gross saving to GDP during 1970-84 in the national economy. This has improved growth performance of the organised industries. The latter received further impetus from additional expenditure on industrial products as a consequence of reduced expenses on wage goods. However, Nadkarni shows that three main Industrial products fertilizers, pesticides and diesel were mainly responsible for turning the terms of trade against agriculture. This is, therefore is different from earlier thesis of 'urban - biased' in Indian economy's planning. Nadkarni warns against such an increase in production which raises the cost of production in the long run.

I.J. Ahluwalia also concludes that slow progress in Agriculture was mainly responsible for stagnation in Indian industries since late 60s. G.K. Kumar also supported I.J. Ahluwalia by raising doubts about the notion that unfavourable inter sectoral terms of trade for industry was the possible dynamics in slowing down industrial growth since mid 1960s.

On the other hand, Thamarajakshi has remarked that while raising agricultural prices so as to have a definite influence on agricultural outputs, their spiralling effect on non-agricultural prices would be quite evident. She contends that terms of trade for the farm sector may depress the overall saving rates whereas the situation may be availed by big users in applying new technology or this may be capitalised into higher land prices there by increasing the cost without raising the output. It can be derived from these arguments that agricultural growth would exert an influence on the industrial growth. But it is not necessary that the favourable terms of trade for agriculture would slow down the industrial progress or necessarily help in the modernisation and technological upgradation of the agricultural sector. In the effort to evaluate structural changes in the Indian economy. Zaidi and Mukesh upadhyaya found low dependency between agriculture and industry for inputs. However in

the gradual process inter dependency has been increasing, implying increasing intersectoral relationships.

It has been found from several studies in 80s that the sectoral relationship between agriculture and industry lacks required strength. Partly it was due to the state led expansion of industrial sector that results in high degree of disproportionality between growth of the two sectors. It is due to the fact that industrial policy, during 70s and early 80s was aimed at import - substitution, protection is in and establishment of key industries by public sector. Further, there was dissociation of industries by public sector. There was also dissociation of industrial expansion from the mass markets particularly in the rural sector. In another analysis, it is argued that during the first decade of Indian planning, the savings constraints was dominated quite quickly by the agricultural constraints. Therefore, much emphasis was placed in the form of green revolution. Still it did not affect economic growth substantially because policies were formulated on the basis of wrongly perceived savings constraints. Thus, agriculture suffered at the hands leading to a bad impact on the overall economic development.

India has achieved considerable progress on the agricultural front during 80s. Sukhmoy Chkravarty observes, however, the strength of industry - agriculture linkages seems to have weakened some what over three decades of planning. He explains this change through four major forces which have pulled down the growth stimulating effect of agriculture. First; growth in agriculture has been mostly stimulating in particular crops i.e growth in agriculture has been mostly of foodgrains whereas commercial crops did not register much growth. Secondly, the application of new agricultural strategy has exerted pressure on import. Thirdly, industrial production has been oriented towards highly capital and import intensive consumer durables. Fourthly, the Indian capital goods sector has been facing high competition from imports. Therefore, he suggest that possibly more is needed today for rapid industrialization than maintaining a satisfactory performance in agriculture, particularly because agriculture itself becomes more import -dependent than before". He therefore suggests for export - oriented industrialization.

An evaluation of the four decades of long period of economic development shows that there is no definite and consistent relationship between industry and agriculture. K. Parikh observes that even with 3% growth in agriculture, 7% annual growth of Indian economy is possible in 1990s. During the last 2 years of the 8th plan, the economy achieved 7 percent annual growth - rate, whereas the growth of agriculture has been fluctuating around 3 percent. Parikh suggests for the provision of sustainable support to agriculture by the industrial sector for higher growth performance of Indian economy.

The famous Arthur - Lewis model characterised the process of development as involving a rise in the profit rate, in the share of profits and hence in the savings to Income ratios consequent upon the transfer of labour from low productivity characterised agriculture to high-productivity characterised industry. It was also thought that countries like India had a comparative increase in the export of industrial product due to low real wage rates and abundant natural resources - supplies.

Rosenstein - Rodan, Nurkse and others thought that a large population size contained an equally large volume of concealed unemployment, nearly zero marginal productivity. Labour could be easily transferred at low social cost to balanced expansion programmes in industry. Maurice Dobb thought that the transfer of labour was continued by transfer of potentially realisable marketable surpluses in grains. It is stated by Nurkse, that organisational and institutional changes in agriculture could overcome the hurdles of the transfer. Generally an optimistic view on population, and possibilities in industrial development tended to emerge.

Karl Marx's hypothesis states that the developed country offers a possible future image of itself to a developing country. What this implies is that the development process would tend to flow on a beaten track and that by and large adaptations are more common, than innovations. Efforts have been made in Rostow's writings to visualise a fore - take-off period, a take off period and a past take off period. The take off is generally associated with

a rise in the savings - income ratio to around 10-12% and then with a steady process of industrialization thereafter.

Empirical resources in the expansion of industry has thrown up a number of interesting hypothesis. No distinct existence of economies of scale has been proved. The factors for industrial growth have been investigated and it has been found that the general index of industrial production and indices of categories are all positively and significantly affected by the surplus in aggregate - agricultural and industrial consumption expenditure above that for necessary outlays as for food articles, clothes and fuel. Broadly agricultural output has a more powerful effect on the indices than does autonomous expenditure. In general, all this supports the thesis that productivity of the crucial wage goods sector is the important determination of market for industrial products. Again the crucial role of agricultural productivity is obvious as a determinant of the surpluses for purchases of industrial goods. Agriculture has been found to be absorbing more and more of industrial inputs. Future growth prosperity of industry seems to depend upon agricultural growth and productivity therein. Growth of rural incomes and surpluses is the key to high industrial growth.

In VIIIth world economic congress of international economic association held in Delhi on 1st to 5th of December 1986, many economists expressed their views about the relationship between agriculture and industry. B.B. Bhattacharya and C.H. Hanumanth Rao in their paper. "Agriculture - Industry interrelations; Issues of relative prices and growth in the context of public investment," said that the direct link between the agriculture and non-agricultural output seemed to have become weaker in the post green revolution period. The partial elasticity of the non-agricultural output with respect to the former has declined from 0.15 for the earlier period to only 0.03 for the later period. Two factors might have contributed to this, firstly, the decline in output and secondly, the slow growth of employment in the organised private sector reducing the quantity demanded of agricultural output. The public investment in agriculture seems to produce significant complementary effect on the private investment in agriculture. The direct effect of public investment and private investment in

non - agricultural sector has however become very weak and significant, presumably because of the overall complementary effect of public investment in non-agricultural production continues to be significant through the supply of public infra-structure on non - agricultural output and investment.

Dr. V.K. R. V.Rao in his paper, "Balance between agriculture and industry in economic development" said that "Thus agriculture is still a dynamic sector in the economic growth, but this does not mean that it can take the place of the industry in maximising the growth of the GDP". In fact it is the investing rate of better technology and supporting investment that has made the agricultural sector prosper and the same would be even more true for the industrial sector and the service sector. In other words the emphasis in planning for rapid economic growth must now shift from sectoral attention to that of the methods used in production, supporting investments and appropriate but modern technology. So far he has been dealing with economic growth identifying it with development and assuming the GDP as the measure of development and sectoral growth as the means for maximising the GDP.

Shri K. K. Singh and Praveen Krishan in his article "Terms of trade and output responses of agriculture and industry in India; some propositions said that during the plan period, the agricultural and industrial prices in India have shown definite trends". A scissor trend during the first plan and rather on steeper rising trend after 1960 is quite notable. This indicates a more favourable terms of trade for the agriculture sector.

In economic and political weekly, Shri Thamarajakshi in his study "Agricultural growth, rural development and employment - generations", said that even the determination in terms of trade observed since 1973-74 is perhaps more a reflection of the acceleration in demand for modern input by agricultural sector.

D.N. Jha in his study on "Agriculture - Industry inter - relationships: lessons from developed countries", observed that the agricultural exports could play a very prominent

role in the process of economic development. Also agricultural sector provided the main market for Japans's import industries. Jha, therefore, recommends for not only increasing the productivity of labour by shifting the surplus labour from the farm sector to the non-farm sector but also advises for increasing the marketed surplus through application of appropriate technology. As a result the surplus over domestic requirement will reflect foreign exchange needed for economic development.

D.K. Das in his paper "Agriculture-industries interrelations in India" finds that the food supply fails to increase at a rate appropriate to increase in the per capita real income. Moreover high income elasticity of demand for food inputs sets an upward pressure on food prices and consequently sets up a wage - price spiral in the economy. Therefore food shortages reinforces inflationary pressure. He suggests that the pattern of development of agricultural sector should strike a balance between food articles and commercial crops to provide adequate raw materials for industrial development. Industries which are directly or indirectly involved in the production. Industries which are directly or indirectly involved in the production of wage goods and those catering to agricultural input like fertilizers, pesticides as well as building and construction materials are of fundamental importance to check the inflationary pressure in the economy. R. Mukherji, in his study "Agriculture - Industry relationships in India" analyses for broad inter relations, viz input - output production expansion, price movements and channelling of the savings between the two sectors. He finds that there is increasing dualism between the dominating small scale agriculture and some emerging patches of commercial agriculture using modern inputs. There is rising capital - output ratio and increasing losses in the operation of the public sector enterprises and the industrial and agricultural sector that hampers the development of India. Further, the operation of price mechanism contributing to the favourable terms of trade for the industry aggravates the problem of allocation of resources in the economy. He suggested for balanced and proportional development of industry and agriculture.

In his study, "Intersectoral linkages and economic growth in India", T. Haque observes

that the growth rate of industrial output is positively co-related with growth rate of production of foodgrains per capita. Further the study indicates that during the period 1956-57 to 1973-74, the intersectoral terms of trade have been relatively unfavourable to agriculture. He finds that during the same period, the relative share of per capita consumer expenditure on agricultural products marginally increased in both urban and rural areas, while that of non-agricultural products declines, thereby confirming that the national market for industrial consumption goods in India is limited due to the low level of per capita income and slow growth of income particularly that of agricultural income. This seems to be one of the major bottle necks to industrial development in India as observed by Haque, Hence the need for balanced growth of agriculture and industry arises for overall accelerated economic development.

The study by Jaydeb Sarkar entitled. "The terms of trade problem and agricultural industry inter relations in India" shows that the uneven development of industrial and agricultural sector is mainly responsible for the adverse movement in the terms of trade. Too much emphasis on industrial development and neglect of agricultural sector has created shortages of agricultural goods leading to a rise in the prices of agricultural goods relative to the prices of manufacturing goods. The study recommends that agricultural productivity should be increased in order to solve the problem of unfavourable terms of trade for agriculture.

In the process of development there should be transfer of labour force from agriculture to industry. It generates reverse flow of funds from earning of shifted labourers employed in industries and financing agrarian growth. S. B. Mehta in his study "agriculture industry interrelations in India" point out two important factors which have hampered the interflows of labour and income. These are (1) Inappropriate policy measures for agricultural growth and (2) Inadequate and ineffective investment in agricultural policy measures. This has been shown to be appropriate from the point of view of an ever increasing number of small holdings, creating non-viable uneconomic farms. A number of measures to help the small and marginal farmers have been able to stick to their farms rather than moving to other agro industries or

non - agricultural sectors. Hence our approach to help the rural poor, should be to provide them loans, subsidies and other aids so as to enable them either to set up, or to work in, viable, portable and self sustaining industrial units and gradually to remove them away from their small farms; Mehta recommends that other approach in helping the rural poor farmers should be to develop for them more and more viable and healthy industrial units in semi urban and urban areas, so that the surplus labourers from the farm sector may be absorbed in the non - farm sector drawing high wages permanently.

2.1 Growth pattern of Indian agriculture

2.1.1 Pattern of Growth in output of crops.

The agricultural sector continues to be an important contributor to the GDP of the country, despite its decline in percentage terms since 1950-51. Analysis of state level data on areas and output of 40 crops for 30 years from 1962-63 reveals that - there was market acceleration in growth rate of output between 1980-83 and 1991-95. Another notable thing is that the cropping pattern changes away from coarse cereals towards rice and wheat. On the other hand it shift away from to other paying crops. We have tried to solve the intrincating issue relating to the sustainability of high growth ratios for rice and wheat in the generative and trans gangetic plains. Moreover, agriculture has been playing a major supportive role in the economic reform programme in the country and there has been a persistent demand for the removal of regulations and restrictions on agricultural sector on the grounds of government intervention in the sub-sector of agriculture specially agricultural marketing and price fixation¹.

Another point which has been emphasized here is the crop diversification. As per condition for crop diversification in a large country is to accelerate the growth of foodgrains through increasing the productivity of wheat, rice and other foodgrains, since food security continues to be of paramount importance. Given, adequate supply of foodgrains a more important diversification that needs encouragement is the one from low value crops to high value crops like fruits, vegetables, flowers and other horticultural crops.

In India, area allocation among various crops reflects the traditional character of Indian Agriculture. Area allocation has shown a measure of structural rigidity where in foodgrains remain the most predominant crop. It is only during the period 1980-83 to 1992-95 that many important changes were reflected in the cropping pattern. During the period of

18 years from 1962-65 to 1980-83, for India as a whole gross cropped areas increased from 158 million hectares in 1961-65 to 175 million hectares in 1980-83. Area under the 40 crops increased from 152 million hectares to 166 million hectares during 1961-65 to 1979-83. Cropped areas under foodgrains did not show any considerable change during this period. Foodgrains occupied 78% of cropped areas in 1961-65, its claim was not much different during 1980-84. The new technology introduced during the mid 1960s failed to diversify the cropping pattern since it was basically confined to wheat and rice. During 1961-65 to 1980-84 the areas under wheat registered a phenomenal increase and its share in total cropped area increased from 9% to 13.5%. On the other hand share of coarse, cereals and pulses recorded a notable decline. This change in cropping pattern has been observed on an all India level. Because of high yields and a remunerative price both wheat and rice registered considerable increases in their share whereas coarse cereals, pulses and oil seeds were being displaced due to lower yield and declining relative profits.

Table 1

Area trend and importance of Rice-Wheat rotation in Indo-Gangetic Region
(Area : Million hectares)

States	Area under Rice- Wheat Rotation		Rotation area as %age of total area		Rotation area as %age of net sown area	
	1958-60	1985-90	Rice	Wheat	1958-60	1985-90
Bihar	0.58	1.60	37.0	81.00	7.50	21.11
West Bengal	0.05	0.30	5.20	100.00	0.75	5.65
Uttar Pradesh	2.00	4.30	78.5	48.50	11.00	25.00
Haryana	0.40	0.45	65.5	23.50	12.10	14.11
Punjab	0.40	1.50	73.0	45.70	10.90	35.90
Madhya Pradesh	0.75	0.90	18.0	26.50	4.65	4.75
Other States	na	0.42	9.00	24.20	na	0.51
All India	na	9.50	23.0	39.00	na	6.77

Source : Rice Wheat Atlas of India and ICAR, 1994

Table 2

State wise growth rates in yeild of Wheat and Rice between 1971-72 to 1994-95

(Percentage / Annum)

Period	Bihar	West Bengal	U.P.	Harayana	Punjab	India
<u>Wheat</u>						
1970-75 and 1975-80	-0.95	-1.25	3.50	3.01	2.25	2.40
1975-80 and 1980-85	2.86	2.10	4.80	3.01	3.10	3.99
1980-85 and 1985-90	2.11	-1.95	2.81	4.45	2.91	3.15
1985-90 and 1990-95	3.57	1.40	2.50	3.26	2.30	2.91
<u>Rice</u>						
1970-75 and 1975-80	0.50	1.30	2.75	6.71	6.11	1.75
1975-80 and 1980-85	0.21	0.70	4.91	1.60	1.81	2.29
1980-85 and 1985-90	4.16	5.51	5.67	0.15	1.27	3.27
1985-90 and 1990-95	-0.02	3.20	3.45	1.67	1.00	2.65

Source : Agricultural statistics at a glance, Directorate of Economics and Statistics, Government of India, New Delhi, Various Issues.

Table 3

State and Region wise growth of Agricultural output

State	1971-74 over	1981-81 over	1992-95 over	1992-95 over
	1962-65	1971-74	1981-84	1961-64
Haryana	4.66	3.01	4.75	4.15
Himachal Pradesh	3.33	0.97	2.21	2.07
Jammu-Kashmir	5.38	3.45	0.33	2.70

Punjab	6.64	4.75	3.87	4.90
Uttar Pradesh	2.55	2.77	2.81	2.77
North-West Region	3.60	3.20	3.30	3.40
Assam	1.87	2.77	2.15	2.30
State	1971-74 over 1962-65	1981-81 over 1971-74	1992-95 over 1981-84	1992-95 over 1961-64
Bihar	1.11	-0.40	2.08	1.00
Orissa	1.00	2.67	1.15	1.60
West Bengal	2.38	6.67	5.40	3.00
Eastern Region	1.56	1.10	3.00	1.97
Gujrat	1.77	3.11	1.97	2.30
Madhya Pradesh	1.97	1.27	4.70	2.81
Maharashtra	-3.65	6.57	2.86	2.30
Rajasthan	4.30	1.27	5.01	3.57
All India	2.07	2.37	3.40	2.70

- Source :**
1. Government of India, Area and production of principal crop in India (Various issues), New Delhi.
 2. Government of India, Primary census Abstract; office of the Registrar General and Census Commission, India, New Delhi. (1961, 1971, 1981 and 1991 census)

Crop wise data on area and output of different crops for 15 major states and regions have been obtained from government of India publication, ministry of agriculture. The main purpose of this data is to undertake a brief review of the regional patterns of levels and growth of agricultural output in India since 1961. The main components of output growth is yield increase, area increase and cropping pattern changes. An attempt has been made to study the contribution to agricultural growth in various regions made by these components. It has been attempted to analyse over time, the relationship between the growth of output and land labour productivity. During the first phase of the green revolution from 1962-65 to

1970-73, the new technology was only confined to wheat and the main beneficiaries were the irrigated north - western states of India including West Bengal. But the main food crop, rice was not considerably influenced by the modern technique of production as is evident from the rice growing eastern states which could not derive appreciable gains from the new technology.

Only a few states were able to drive remarkable gains from the modern Agricultural technology. This resulted in greater regional inequalities. Crop-output in the dry rainfed area in the central region was only marginally influenced by the green revolution. Rajasthan recorded a high growth rate of 4.30 percent whereas Maharashtra's growth rate was 3.65 percent. Gujarat and Madhya Pradesh recorded a growth rate of only 2 percent. The north western states of Punjab and Haryana maintained their high rates of growth in the extended period from 1970-74 to 1980-84 characterising new seed - fertilizer technology. An analysis of incremental output confirms this high rates of growth during this period. Gujarat substantially increased its growth rate from 1.80 percent during 1962-65 to 1970-73; to 3.11 percent during 1970-74 to 1980-84. While Andhra Pradesh registered a sharp acceleration in growth rate, the Tamil Nadu recorded a negative growth rate. Karnataka was almost stagnant as per its growth rate. The most significant development was a remarkable acceleration of growth in the eastern region. West Bengal was at the top among the growing states of eastern region. Its performance was creditable, as its growth rate increased to an unprecedented level of 5.40 percent. Bihar also recorded a significant acceleration in growth rate from -0.40 percent from the first phase of new technology to 2.10 percent in the second phase of advanced and extended technology.

We observe that though eastern India being agriculturally stagnant recorded a high acceleration in the growth of output in the third phase of extremely developed technology². The acceleration of the growth in the highly populated but also agriculturally highly stagnant states of eastern India was a development of major significance because accelerated growth rate in agriculture would be able to meet the growing needs of their high population. The

central region also recorded an acceleration in its growth rate. There was a significant acceleration in the growth rate of Madhya Pradesh and Rajasthan. In case of Maharashtra and Gujarat we observe a different matter. Due to persistent draught rate, among the southern states, the growth rate accelerated very significantly even higher than that of north - western region. During 1980-84 to 1991-94 Tamil Nadu recorded a growth - rate of 4.6% which was creditable due to its negative growth rate during the earlier period. In absolute-terms, the output during 1991-95 over that during 1980-83 registered an unprecedented increase of 417.00 billion which is nearly three times the increase registered during the earlier period.

2.1.2 The Yield effect on output performance

During the first 20 years since 1961, the impact of new technology in transforming traditional agriculture was mainly confined to the north western and southern states. Even in these areas, the magnitude of change could not make a visible dent on structural rigidities with respect to the growth rate of output, crop diversification and labour transformation. However, as a whole its impact was more or less significant. A most interesting development was the exclusion of the green revolution to the eastern region. The growth of output in southern region was also reviewed. Rajasthan and Madhya Pradesh recorded a vary high growth. In case of north western region, the growth rate was remarkable except slow rate in some particular years, due to natural calamities. Shifting of cropping pattern from coarse cereals to oilseeds and other commercial crops was particularly strong in the central region specifically in Rajasthan and Madhya Pradesh. The period from 1980 to 1995 witnessed a much higher growth rate of 3.50 percent in agricultural output. The maximum credit to this all India growth goes to eastern and southern states. This was further supported with a continuation of high growth rate by the North Western region and considerably good performance by the two major states of Rajasthan and Madhya Pradesh in the Central region.

It is noticed that initially in labour-abundant economies like India, a remarkable

agricultural growth rate results in an increase in demand for labour which further raises the agricultural wages. This higher degree of labour absorption tends to reduce inter regional difference in labour productivity. We observe that agricultural growth and crop diversification is not accompanied by any significant change in labour force diversification. More than half of the total agricultural workers spread over most of the states in India in favour of commercial crops. This lead to a significant increase in labour productivity. This may further lead to much higher wage rates in most parts of India. Obviously it would increase the rural profits.

There is a considerable scope for increasing productivity in eastern Utter Pradesh. It is supported by a highly developed infrastructural facilities. There is good scope for crop diversification in favour of high value crops. The North Western region as whole, posses a highly developed infrastructure in irrigation, research and marketing. Considerable food surpluses would be continued in this region in the coming years. Moreover other new areas like Madhya Pradesh along with some southern states would be emerging as areas of food surpluses in the near future provided they are supported by agricultural research and appropriate policy formulation.

In the eastern region a notable development has been observed in irrigation facility. The growth rate of crops in this region has been made possible due to significant increases in Area under irrigation. This was mainly financed privately. The availability of assured irrigation continues to be the essentially precondition for the adoption of new - seed fertilizer technology. The rapid agricultural growth experienced by west Bengal (Eastern region) is mainly due to the spread of irrigation network. However most of the eastern states which have been agriculturally stagnant for a long period of time are still lagging behind as compared to other states specially north western in terms of growth. Whole of the eastern region suffers from fragmentation of holdings, hence land reform should receive higher percentage. These states have been adopting outdated techniques. There is an urgent need for consolidation of holdings.

An analysis of inputs use in various states of India including Bihar and Orissa states that high levels of growth and yield were brought about through increased use of fertilizers and minor irrigation³. The level of fertilizer use in earlier sates is extremely low along with immediate availability of institutional credit. Hence the development of institutional credit should be given high priority so that level of inputs use specially that of fertilizers may become higher. Moreover farmers should be acquainted with modern technology through highly experienced and trained Agricultural professionals.

We have divided the central region into rainfed and non-rainfed areas In rainfed areas though the rate of crop output have been higher as compared to the period 1961-80 but we find fluctuations in crop output because of uncertainty of monsoon and lack of irrigation facilities. Moreover non - development of dry land farming technique makes the condition still worse. The lack of availability of assured irrigation and draught prone areas are the major problems of this region. We conclude that these areas are the major problems of this region. We conclude that in rainfed areas investment in irrigational facility should be expanded through large river valley projects, whereas in non-rainfed areas, appropriate technology for dry land farming should be developed. However we notice that Madhay Pradesh and Rajasthan have been able to shift large agricultural areas from low yield and low value crops to high yield and high value crops. Thus these states recorded significant diversification in terms of yield and value there-by increasing the farmer's income.

Investment in new technology has assumed too much importance in the context of present day economic liberalisation. Hence it is advised to invest heavily in Agricultural research, development and extension³. Research should be undertaken for shifting of low value crops towards high value crops like fruits, vegetables and other horticultural crops. The technological efforts should not only be confined to already agriculturally developed states of North Western and southern regions and should not be confined only to particular crops like wheat and rice but rather it should spread over the country as a whole and over all high yield and high value crops.

Table - 4
All India compound growth rates of area, Production and yield of majour crops : 1963-66 to 1993-97

Crops	1963-66 to 1971-74			1971-74 to 1981-84			1981-84 to 1993-97		
	Area	Product	Yield	Area	Product	Yield	Area	Product	Yield
	0.47	1.51	1.05	0.60	2.21	1.65	0.51	3.60	3.03
	4.30	10.86	6.25	1.81	4.51	2.65	0.60	3.81	3.20
	-0.07	0.63	0.69	-0.55	1.33	1.87	-0.25	0.91	2.70
	-1.21	-0.33	0.87	0.51	0.37	-0.15	-0.30	1.37	1.65
	0.44	2.70	1.81	0.40	2.25	1.87	1.67	2.99	3.25
	0.37	1.77	1.39	1.15	2.55	1.45	1.35	4.10	2.40
	0.15	0.01	-0.16	-0.18	0.70	0.85	3.70	2.90	1.55
	1.51	4.42	2.90	1.87	2.81	0.95	3.09	7.30	3.50
	0.42	1.17	0.75	0.90	1.81	0.95	-0.60	5.65	2.50
	-0.77	-0.21	0.67	0.33	2.47	2.15	-0.60	3.33	3.99
	-1.51	-1.49	0.05	1.00	2.11	1.11	-0.45	1.55	2.15
	-0.66	0.11	0.77	0.30	2.51	2.25	-1.75	3.65	4.20
	-0.64	1.75	1.10	2.15	3.81	1.66	1.37	2.70	1.33

Source : Government of India, Area and Production of principal crops in India (Various Issues) Ministry of Agriculture, New Delhi.

Table - 5
Share of various crops intotal output of regions

Region/Period	Rice	Wheat	Coarse	Pulses cereals	food grains	non food grains	Fiber oilseeds	Cotton Crop	Sugercane
North Western Region									
1963-66	13.00	15.70	11.25	23.23	62.70	37.30	4.89	4.65	18.21
1981-84	19.90	35.10	6.50	8.60	70.10	29.90	4.25	4.15	14.47
1993-97	24.10	37.30	4.81	5.70	71.70	28.30	4.60	4.56	13.60
Eastern Region									
1963-66	60.89	1.45	3.33	12.11	77.70	22.30	4.55	0.05	3.87
1981-84	51.00	7.70	3.39	8.89	70.15	29.85	3.77	0.03	3.15
1993-97	57.9	7.79	2.61	4.77	72.59	27.41	3.16	0.02	1.75
Central Region									
1963-66	13.81	7.81	20.43	16.40	59.10	40.90	11.81	11.77	4.15
1981-84	12.89	12.45	18.20	15.50	59.20	40.80	9.33	9.29	6.71
1993-97	11.66	12.61	13.81	14.30	52.07	47.93	8.37	8.30	5.77
Southern Region									
1963-66	32.30	0.26	12.15	3.35	46.90	53.10	3.66	3.47	5.91
1981-84	32.10	6.33	10.10	3.81	45.30	54.70	3.81	3.67	8.87
1993-97	27.10	0.20	6.76	3.33	37.70	62.30	4.45	4.35	8.90
All India									
1963-66	27.89	6.29	12.40	13.50	60.10	40.00	12.41	6.43	5.37
1981-84	25.99	14.87	9.91	9.16	60.25	39.77	10.95	5.45	4.70
1993-97	26.77	15.60	7.41	7.25	57.00	42.95	14.11	5.37	4.81

Source : 1. Government of India agricultural statistics (Various Issues), Ministry of Agriculture, New Delhi.
2. Government of India, Area and production of Principal crop in India (1997)

2.1.3 Variation of Area under different crops

The High yielding varieties of seeds and fertilizer technology, in its initial stage, showed remarkable positive impact upon the growth and yield rate of wheat and rice but as the new technology developed further it also showed growth oriented impact upon other crops which had been neglected during the mid 1960s. As a result, besides wheat and rice other crops like coarse cereals, Soyabean, cotton, sugarcane and mustard showed increasing growth rate but not of the level of wheat and rice. This differential increase in yield levels and consequently changes in relative prices lead to different growths for different crops in agriculturally developed and underdeveloped states of India. In India area allocation among various crops has shown a measure of structural rigidity that reflect the traditional character of Indian agricultural. In spite of some changes in growth pattern of crops due to new technology, foodgrains still remains the most predominant crop. It is only during the mid eighties that many significant developments took place in the cropping pattern of India from mid 1960s to mid 1980s. Gross cropped area as a whole increased from 160 million hectares to 175 million hectares and in case of forty crops increased from 150ml. hectares to 164 million hectares. Foodgrains which accounted for 78 percent of gross cropped area under forty crops during mid 1960s still covered 77 percent of area during early 1980s.

The given table reflects that during the period early 1960s to early 1990s the highest growth rate in yield and output was recorded in rice and coarse cereals. The lowest growth rate in yield and outputs was recorded by wheat followed by cotton, rapeseed and mustard, rice and coarse cereals⁴. The lowest growth rate in yield and output was recorded by pulses groundnut and sugarcane. Area allocation among various crops has shown a traditional character of Indian agricultural where as foodgrains remain the most predominant crops. Although the introduction of new technology did make some improvement in this pattern, but it rules out any significant impact upto 1982. It is only during the period 1982-97 that many important changes took place in the cropping pattern. In the green revolution effected area specially the north western states, because of higher yields and a remunerative price regained in case of both wheat and rice registering significant increases in their share in

total output.

In the North-Western states the share of area under rice in total cropped area increased from 15.5 percent in 1965 to 20.90 percent in 1985 and that under wheat increased from 20.5 percent to 35.3 percent. Because of changes in relative profitability and low yield, coarse cereals, pulses and oilseeds were rapidly being replaced by higher productivity and higher relative value crops like wheat and rice. Although the share of total foodgrains in cropped area remained nearly constant at about 80%, their share in total value of output increased from 63 percent during 1963-66 to about 70.5 percent during 1985-87. There was a substantial increase in area under wheat in West-Bengal at the cost of pulses. In Orissa there was a sharp decline in the share of area under rice and an increase in the share of area under pulses and coarse cereals. In terms of value of output, in the eastern region, wheat gained very substantially mainly at the cost of pulses. In the central region also wheat gained at the cost of pulses, coarse cereals and oilseeds. There was a sharp decline in the share of coarse cereals in the southern states and a small decline in the share of coarse cereals in the central region while both the southern and central region reflected a small increase in their share of area under pulses. The area under oilseeds marginally increased in the southern region in the period 1985 to 1997. It reflected significant changes in the cropping pattern, which had not been observed during the last 35 years. The most important of All India's level change was brought in the proportion of area under foodgrains which had almost remained constant during 1961 to 1984. Within the foodgrains, there was a slow down in the increase of area under wheat and there was an increase in the area under rice.

The most important feature of changes was that at the All India level, the proportion of area under foodgrains which had remained almost constant during 1963-66 to 1981-84, registered a sharp decline of 5.9 percent from 75.55 percent of total area in 1981-84 to around 69 percent during 1993-96⁵. The gross - cropped area increased from 175.5 million hectares in 1981-84 to 185.7 million hectares in 1993-96. Area under foodgrains declined by over 4 million hectare from 127.9 million hectares in 1981-84 to 123.5 million hectares in 1993-96.

Conclusion

The process of agricultural reforms need to lay emphasis upon the development of technology, fertilizers, irrigation, infrastructure and credit. These supply side factors are the prime movers being accelerated and sustainable growth of Indian Agriculture. Technology, fertilizers and irrigation in a developed form increases the aggregated Agricultural crop's supply. The process of economic reforms and the gradual opening up of Indian agriculture to world market is likely to turn the terms of trade in favour of agriculture. Agricultural research and growth centres are required to develop location specific technologies. It should lay due emphasis on biotechnologies. Agricultural research system should be revamped so as to upgrade the extension system, to become more accountable to farmers.

Broad policy changes relating to the supply and subsidy for agricultural inputs may accelerate not only the growth of Agricultural sector but also provide momentum to overall growth of the economy at the macro level, raising public investment in irrigation along with institutional reforms in irrigation system is required. In order to reduce the grand water depletion volumetric pricing of electricity is a necessity. Farmers should be given managerial role in irrigation department. Fertilisers subsidy should be reduced. Policies geared towards wider distribution of fertilizers would bring better results. Organic manure is more efficient than chemical manure but due to high subsidies on chemical manure use of the latter becomes economical. Therefore policy conclusion is the need to make organic manure more attractive economically also by lowering down subsidies on chemical fertilizers. Organic manure should be accorded a high priority because it does not put adverse impact upon environment apart from being more production oriented.

Credit policy for agriculture should aim at improving the economic viability of Banking and non-banking Agricultural credit institutions apart from providing institutional credit to poor farmers by ensuring a stipulated share for agriculture. This will discourage the tendency of bankers to reduce unit cost of service by serving a small number of big borrowers rather than a large number of small borrowers. It has been seen that large farmers have been the major beneficiaries of the long term loans advanced at a very low rate of interest. Their share in total institutional credit has been found larger than share in total Agricultural area operated. Thus lending by credit institutions to large farmers at such a sensational rate violates the rule of equal distribution of credit irrespective of one's political and social approach. That is to say that these institutions should adopt professional approach and necessary precautions in lending in order to discourage recycling of credit resulting in adverse impact upon poor farmers. Thus in view of the scarcity of credit and the very high rate of interest charged by these bankers, loan advances should be based on the professional appraisal of investment projects, instead of being based on targets for the disbursement of credit.

The central government has moved in a decisive manner to increase the public investment growth rate in response to the downward trend observed in Agricultural public investment since 1980-81. Public capital formation in agriculture should be stepped up by about Rs. 300 crore at 1980-81. Because in order to recover the loss due to reduction in capital formation on public sector account since 1980-81 it has been assessed that one rupee of public investment in agriculture leads to an additional one rupee of private form investment. This indirect enlargement of capital stock due to complementary effects of public investments on private investments of a substantial magnitude; one single most objective of public sector's farm investment has been food security. Each additional rupee of borrowing by the states resulted in about two fifths of a rupee worth of fixed capital formation in agriculture on Public Account over the period 1961-95. And one rupee of additional savings in its revenue budget gives rise to about one third of a rupee worth of

public capital formation in agriculture. The problem of decline in Public capital formation in agriculture is not one of the resource flow to agriculture but one of 'balance' between current account expenditure on subsidies and expenditure on capital formation.

Agricultural trade liberalisation affects domestic prices of different commodities in varying ways. Relative changes in prices of different commodities leads to a change in cropping pattern and allocation of inputs such as organic and chemical manures to different crops. This results in changes in output of level of different crops and consequently crop wise income as well as total income also changes. The trade pattern will also change in response to liberal agricultural policy. Agricultural trade liberalization should be taken into account while formulating appropriate policy for subsidy expenditure and foodgrains output, so agricultural taxation and other macro economic objective. In the long run, liberalization leads to higher volume of exports of all agricultural goods except coarse grains⁶. Prices of several agricultural commodities would rise with trade liberalisation whereas prices of coarse grains and other foodgrains which have been protected so far, would fall alongwith the rising trade liberalization.

Agricultural policy reform issues ought to be looked from the angle of social objectives of agricultural development and not from supply angle of total output and Income. The policies relating to market intervention and regulation need to be sketched out for the realisation of social purposes. A policy of support prices would be necessary as an incentive to production and for agricultural income stabilisation for ensuring national food security and for meeting the requirement of the PDS. A PDS targeted to the poor, the open market purchase of the required quantities is preferable to the current procurement policy. Removal of all government interventions from the agricultural commodities and factor market is not justified. Though removal of all government intervention may improve allocative efficiency of resources in agriculture, induce higher provision of capital formation and lead to higher growth of output, export and income but for certain social purposes like national food security and rural poor economic security market intervention is necessary particularly in case of

production shortfalls. Therefore in cases of production shortfalls and market failures government's intervention in the commodity and factors market is necessary and advisable in order to fulfill the social purposes of growth, equity, food security and poverty alleviation.

2.1.4 Technological changes in Agriculture

The traditional technology was the main source of agricultural growth during the period; 1952-53 to 1964-65. The new technology was introduced in 1964-65 for raising agricultural production. The past technology period may also be divided into two sub groups: (a) Initial phase of the new technology from 1966-67 to 1977-78, and (b) modernisation phase from 1978 - 79 to 1991-91, although mainly the 1980s have been considered as modernisation phase because of increasing capacity utilization in Indian agriculture. We prefer 1978-79 as the cut off year for modernisation phase because 1977-78 being a good agricultural year had depressed the terms of trade and since then the barter terms of trade could not become favourable to agriculture in most years during the 1980s. The stages of production are broadly represented by the phases of agricultural development. The impact of terms of trade on output, income and investment differs among stages of production.

The interrelationship among technology, terms of trade; growth performance and investment are so complex that only general equilibrium analysis can provide estimates of various effects of these factors intersecting with each other, operating at times in different directions⁷. Further covering a wide range of issues over long period does provide enough scope for sophisticated statistical analysis. Such study does not seem to provide an insight into the growth process that had taken place in different phases of Agricultural development. To understand the dynamics of agricultural development, the interrelationship between growth performance and the technology has been examined along with statistical analysis of different

phases namely tradition technology phase, the new technology phase as well as the post technology phase.

The stages of production are broadly represented by the phases of agricultural development alongwith contemporary technology⁸. In the first and second phase of development, the impact of adverse terms of trade on farmer's income would be severe, whereas in the third phase, it can be neutralized by productivity increase. Therefore interrelationship among terms of trade, growth of agriculture, technology, rural poverty, farmers income, investment etc. have been examined for each technological phase. The importance of phase will be minimum if the favourable terms of trade in the second phase resulted from the poor agricultural growth in the first phase or if accelerated growth performance in the second-Phase lead to the worsening of the terms of trade in the third phase. Regression coefficient have been worked out for the period 1950-51 to 1990-91 with a view to know about the directions of relationships over the period. Here our intention is not to find out exact magnitudes for absolute production.

Main characteristics of different technological phases of agricultural Development

Items	First phase from 1951-52 to 1964-65	Second phase from 1967-68 to 1977-78	Third phase from 1978-79 to 1990-91
Technology	Traditional	Initial phase of technology	Modernisation
Terms of Trade	Unfavourable	Favourable	Unfavourable
Capital Intensity	Low	Medium	High
Public Investment	---	Increase	Decline
Private Investment	---	Increase	Increase
Return to scale	Increasing	Increasing	Decreasing
Growth performance	Average	Better	Improved

1. This may not hold good, if the growth is so capital intensive that it does not allow enough employment growth to absorb labour force. Such growth may not create strong multiple effect to reduce rural poverty.

Alongwith the technological development, the terms of trade are generally expected to become unfavourable to agriculture in the growth process for the reason that due to rise in income the demand for agricultural commodities works out to be lower than that for non-agricultural commodities. This results in slower increase in the prices of agricultural commodities as compared to non-agricultural commodities and hence unfavourable terms of trade to the Agricultural sector.

In the technology - based growth, the process of terms of trade becoming unfavourable to agriculture benefits the rural poor in the short run, because while raising their output, it reduces not only their relative prices but also the unit cost of production. As a result, the relative prices of cereals turn out to be lower, which in term may help the rural poor because they are the not buyers of cereals. If this becomes evident that the unfavourable terms of trade to agriculture in the long run would be reducing the real income of the poor but in the short run it may increase their real income. This makes it important to analyse, the relative prices of the commodities used by the rural poor.

In the short run, developed technology benefits the rural poor because it helps in increasing the productivity of labour as well as land. This leads to favourable terms of trade for agriculture which further results in higher prices. Thus the income of the farmers increases. But contradictorily it hurts the rural poor because they are the not purchaser of cereals. In the long run, the rural poor are likely to gain from the favourable terms of trade to agriculture via the growth process. Now the question arises, can the adverse impact of favourable terms of trade to agriculture on the rural poor be compensated through the growth process based upon modern technology. We have made an attempt to capture the influence of terms of trade, through its interaction with technology on output, investment and income

of the agricultural poor. For this we have examined relationships between technology based growth output and the agricultural income. To examine the performance of Indian agriculture for policy formulation, various features of technology based growth of agriculture and its relationship with output, Investment and Income become evident since the terms of trade is being treated as a medium concept. In the Indian context, the analysis has to be of a long period. However, estimating the regression equations for longer period which has been attempted here also assumes, that farmer's response to various opportunities in different phases of technological development may be alike. During the growth process of agriculture, as the income rises, the demand for agricultural commodities works out to be lower than that for non-agricultural commodities. Thus prices of non-agricultural commodities increase faster than that of agricultural commodities. In the technology - based growth, due to rising output, the relative prices of farm-goods specially the cereals turn out to be lower due to lower unit cost of production resulting from economies of scale⁹. Thus it is clear that it is only in the short run that the technology based growth benefits the rural poor by declining the relative prices of cereals but in the long-run it adversely effects the rural poor.

Interrelationship between technology based growth, changes in Income,

Investment and terms of trade for the period 1951-52 to 1990-91.

Items	<u>Phases of technological development</u>			
	1951-52 to	1967-68 to	1978-79 to	
	1964-65	1977-78	1991-92	
	(First Phase)	(Second Phase)	(Third Phase)	
<u>Income Changes (1970-71 = 100)</u>				
i. Index	(a) Range	65-93	100-118	99-165
	(b) Average	73.20	107.80	128.30
ii. Annual Growth (%age)		1.00	1.96	3.75

Investment

i. Percent annual changes

Gross fixed capital

formation at 1980-81 press	(a) per hectare	3.08	4.75	0.62
	(b) Total	4.36	4.81	1.27
ii. Gross capital formation	(a) Pulses	---	5.61	(-) 1.43
at 1980-81 press	(b) Private	---	4.49	3.08
	(c) Total	---	4.79	1.20

Share of Input

(a) Modern Input	2.58	16.83	29.18
(b) Traditional Input	97.42	83.17	70.82

Capital Investment

Growth Performance (%age annual change)

i. GDP in agriculture	(a) per hectare	1.87	3.10	2.61
at 1980-81 price	(b) Total	3.30	3.81	2.90
ii. For all crops	(a) Area	1.19	0.98	0.71
	(b) Productivity	1.71	4.23	3.77
	(c) Production	2.88	4.25	3.84

<u>Elasticity of output with respect to input</u>	1.44	1.07	0.87
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<u>Input-Output ratio</u>	2.03	3.12	4.90
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1. Mishra and Chand (1995) Doubts have been raised about the complementarity between Public and Private Investment during the 1980's, Private investment increased whereas Public Investment declined.

2. Charavarty, (1987) Alagh (1994). The argument has also been made for higher public investment for the Agricultural sector by Dantwala (1986) and Rath (1989).

Through the subsequent analysis of the table given above we have been able to draw some significant estimates concerned, when we relate the technology - based growth to the



income of the agricultural sector, we take into account the per capita NDP or the Agricultural GDP as an indicator of growth performance. This explains the changes in the rural poverty on the implicit assumption that it is predetermined.

The percapita agricultural GDP has been almost stagnant over the period indicated by the growth rate of about 0.47% per annum during 1970-71 to 1990-91. The index of agricultural sector has been included as an independent variable while explaining the changes in rural poverty. As the income of the agricultural sector increases, the demand for agricultural labour also goes up. This would consequently lower the rural poverty.

Per capita availability of good grains has shown some increases during 1980s, Whereas there does not seem to be any increase in the per capita availability of food grains during the 1960s and the 1970s. Thus we see that percapita availability of foodgrains has been stagnant for a long time. As when we think of lowering the rural poverty we take into account this supply side factor namely per capita foodgrains availability because this exerts an influence on rural poverty when taken along with demand factors like income change. It is expected that higher availability of foodgrains lowers the rural poverty mainly resulting in the negative coefficient.

The advanced technology as an important factor in advancing the output over a higher production possibility curve has been indicated as a percentage under the high yielding varieties of seeds to total gross cropped area¹⁰. More the area under the higher yielding varieties, higher would be total production as a consequence of higher productivity hectare-wise as well as labour productivity. Thus we can expect a positive coefficient in this respect along with the evidence of positive impact upon private investment.

On the one hand technology advancement reduces investment due to the reduction in relative prices of Agriculture commodities and consequently decrease in the profitability. On the other hand it increases private investment due to favourable influence on output resulting from decreased unit cost of production. In this technology based growth process

the rate of increase in the demand for foodgrains also gets contracted because of its replacement with other forms of calorie intake due to a rise in income. This results in an unfavourable terms of trade. In order to meet the food requirements of the country it is not advisable to allow the terms of trade to become unfavourable for a longer period of time. Thus our intention is neither to make terms of trade too much unfavourable in order to share the gains of the new technology resulting in higher productivity per hectare and per labour. A balance between technology investment, output and Agricultural Income should be maintained in order to rule out other contradictory impacts of technology based growth upon private agricultural investment, profitability and the farmer's income.

The public investment on Agricultural inputs and other related infrastructures plays an important role. It also provides research and development support. While denying the fact of complementary relationship between Agricultural public and private investment we conclude that the role of public investment in accelerating the private investment in the growth process in underestimated public investments is treated as a policy in the planning frame work. India's agrarian transition has been realised through supporting the Agricultural private investment by public investment. Once the issue of investment is examined, the role of public investment becomes quite clear in the growth process.

It seems that the new technology and the gross cropped area have intensified to some extent the effect of irrigation capital stock. Irrigation and capital stock seems to be highly co-related with the new technology and hence very important in influencing the output. The coefficients for the new technology and the gross cropped areas turned out to be significant at 1 percent and 5 percent level of significance. The new technology and output performance have shown positive coefficient. It is evident that the new technology has raised the output, but lowered the relative prices of commodities under the influence of technological break through. As a result the interaction between the technology and relative price of farm goods, have shown negative coefficient.

Level of income changes for agricultural sector shows a negative coefficient at one percent level - explaining rural poverty. The coefficient indicates that as income increases rural poverty declines significantly. It has been observed that during the period 1960-61 to 1987-88 rising output due to advanced technology tended to reduce the rural poverty. It makes the point strong that the growth process in Indian Agriculture seems to be increasing the real income of the rural poor¹¹. It seems that the stagnation in per capita availability of foodgrains for the longer period ; 1960-61 to 1979-80 has resulted into non-significant coefficient. About 76.7 percent of the changes in the rural poverty over the period 1960-61 to 1970-80 are explained by the index of income changes in agricultural sector, percapita foodgrains availability.

The Complementary relationship between public and private investment had been broken during the 1980s. The role of public investment in advancing the private investment turned out to be significant only at 15% level. This weak complementary relationship may be due to declining public investment in agriculture. The public investment accounting for about 30% of total investment in agriculture is decided on the basis of targeted growth rate rather than the terms of trade. Incremental capital output ratio examines the efficiency of investment. Investment efficiency improved during the late 1980s, as ICOR(incremental capital-output ratio) decreased from 4.37 in 1978-79 to 3.31 in 1986-87. This decreased incremental capital output ratio resulting in outputs expansion may be attributed to increasing private investments, modern technology, utilization of modern inputs and infrastructural facilities.

Conclusion

The government intervention for price support or foreign trade should not be exclusively considered as an assurance of agricultural growth. The organisational strategy for implementation of agricultural development must further accentuate decentratistation¹⁵ evolution of financial powers to the agencies accountable and centrally better integrated

management so that the much needed energy and environment expenditure, technology and other resources may prove efficient. Technical change in agriculture should be both sided and central resources may require such a change which may be satisfying technical complemetarity to agricultural production process. Agro processing and farm inputs industries should be given priority so as to facilitate value added technological transformation of agriculture. The strategy for agricultural growth must be shifted from intensive agriculture to technical change. Such a strategy is a necessary condtion because its look may result into low rate of returns. Besides this, such a technical strategy is a sufficient condition to facilitate increases in production at reduced unit cast of production and hence of reduced prices in real terms. This consequently benefits the poor most.

Price support should not be considered as a suffcient factor for agricultural growth because aggregate agriculture supply is price - inelastice and changes in crop pattern are decided more by relative profitability of a particular crop rather than the price itself¹². As far as foreign trade is concerned, infrastructural bottle necks act as hinderance in the growth paths and trade liberalisation plays a leading role only in case of those particular commodities where the country shares the largest portion in the world trade volume. The organisational strategy for implementation of agricultural development must further accelerate decentralistion and debureaucratisation. Rapid expansion of industries for seeds and farm implements and other farm inputs are also importan. Land consolidation tenancy reforms, updating land records and implementation of existing land ceiling should be prioritised . Finally government expenditure on agriculture research extension and education needs to be significantly stepped up. This expenditure must be for developing location specific new seed varieties, resource - centred new technologies, extension services for small farmers and for spreading scientific agricultural knowledge to the farmers.

2.1.5 Impact of New Agricultural Strategy

In the study of New Agricultural strategy we have included new agricultural se ctors,

tradeable and non-tradeable, non-agricultural sector and different rural and urban classes in order to reach some meaningful conclusions. We have also tested the hypothesis that the non-agricultural trade growth is more important for agricultural trade growth than even agricultural growth process itself. India being a large country this importance of accounting for large country effects has been demonstrated. A several equilibrium model has been applied for working out the required result. In the past, inefficiencies of agricultural resources arise due to trade restrictions, in appropriate pricing policy, extent licensing, restrictive export prices etc. The emphasis has been laid down on the responsibility of agricultural trade liberalisation. We have tackled different questions arising regarding the impact of liberalisation on the growth of the economy as a whole. Sector - wise production and price policy formulation except the rice production and export, other agricultural commodities have been treated in parallel to the small country assumption, because the case of rice appears to be different. We use the Agricultural growth and redistribution of Income model of Narayans, Parikh and Srinivasan (1990). Rice Prices represents comparatively large market power. This is evident from the fact that the government of india keeps a buffer stock of rice more than the trade volume of the world.

Under the new Agricultural strategy the trade liberalisation controversy has been given much emphasis because of allocative inefficiency with in the agricultural sector and between agricultural and non-agricultural sectors. So far agricultural sector has been functioning more or less in competitive environment. With the help of analysis we concluded that Agricultural trade liberalisation makes the terms of trade in favour of agriculture to the extent that the real investment increases. Agricultural intrasectoral allocative efficiency is not so strong as the impact of increase in investment¹³.

It should be pointed out that as agriculture trade gets more and more liberalised, terms of trade effect works in favour of agriculture to the extent that the relative prices of farm-goods decreases resulting in lower and lower agricultural prices. This decline in the prices of food - articles alongwith the price of rice results in different impacts on different

expenditure classes. This adverse influence upon the agricultural production due to more and more favourable terms of trade is seen to be compensated more than adequately by the support to the poor consumers due to a fall in the food prices. The study concludes that if India was to export rice freely, the world market price of rice is likely to fall. Thus we find that the difference between international price of rice and India's domestic 'price of rice' is not too much. Therefore rice sector is not so much disprotected as evident from the present world price. The result of this exercise indicates that as rice export rises, domestic rice price increases. The production of rice as well as wheat advances towards the higher production possibility curve resulting in a real GDP gain. As the price of rice and wheat were rising in the country due to large exports the real investment increases resulting in higher production. Thus the production increases resulting in higher income. Thus the production structure shifts favouring both rice and wheat.

Under the new agricultural strategy, the introduction of yield raising new seed, fertilizer technology in the agricultural sector has led to a marked increase in the growth rate of agricultural output. This has been significant in the sense that it has transformed traditional household agriculture into modern, commercial agriculture. The differential adoption of the new seed fertilizer technology in the various parts of India has resulted in significant changes in the regional patterns of levels and growth of agricultural output. The period 1980-82 to 1992-95 marks a major departure from the earlier trend both in the matter of growth rates of output and in terms of changes in the cropping pattern. The growth rate of the value of output not only accelerated during this period, but also spread to many states which had hitherto been left out.

Finally, we take the case of government intervention in an agricultural development strategy aimed to achieve the stated objectives of growth employment food security etc. It has been observed that government intervention in agricultural inputs and output market, domestic and external, are price-distorting compared with an ideal free market situation. We have to know the causes behind the government intervention in agricultural marketing

besides other agricultural sectors. May be that, protection of farmers income relative to industrial and services sector's income. At the time of green revolution, Indian government intervened in agricultural market by subsidising input prices and by paying food at pre-announced procurement prices. Maximisation of food production and hence food-self sufficiency was the ultimate social purpose of the government intervention. It must be pointed out that food self sufficiency does not necessarily mean food security for people living below poverty line. Thus during market failures, the government intervention is necessitated inspite of food self sufficiency. Moreover, in case of unpredictable sharp falls and spurts in output give rise to sharp changes in agricultural prices and hence real income in such situation. It becomes necessary for the government to intervene.

Concluding observations

When food self-sufficiency has been achieved, then government intervention in the form of procurement prices of outputs and inputs subsidies can not be justified. However support prices should be provided to major agricultural commodities particularly foodgrains so as to encourage their production. It would stabilise agricultural income. Hanumantha Rao has noted that procurement prices have become support prices in our country. This leads to fiscal instability. The government's intention seems to serve the interest of the farming group rather than the society for political gain. Another argument relating to the trade of agricultural commodities is that the government should allow free trade in the domestic food markets as well as the foreign markets. The farmers will be able to earn higher incomes though exports becomes of higher world market prices. This matter of intervention need not be looked upon only from the angle of food security but also from the angle of national security and security for the poor. According to provisional estimates in 1993-94 PDS off take was 15 million tonnes of food in which wheat's quantity was 6 million tonnes. Maximum buffer stock for future food uncertainties has been put at 10 million tonnes. Hanumantha Rao¹⁸ (1995) has rightly suggested that PDS should be targetted from the angle of security for the poor only and not for the whole population. The Government without interfering in

the free market should purchase the PDS requirement from the open market.

Even if the government buys from the open market, the problem will not be fully solved. The only advantage is that the agricultural market will be free from government intervention, because moving from procurement to open market purchases gives only a symbol of non-intervention in the market. If the government purchases the buffer stock and the PDS requirement for the poor, it will be sharing in the total purchase (marketed surplus) to the extent of around 25 percent. Thus the government will emerge as a single largest buyer leading to a transformation of competitive market into a monopolistic market, governing a significant influence in the agricultural market prices. We conclude that the government whether purchases at pronounced procurement prices or from the open market, it will necessarily lead to price distortions. However when we are to choose among the two, obviously open market purchases will be preferable, because in order to fulfill the objective of food security for the poor, this kind of purchase gives the freedom not to stop purchases until and unless its requirement is fulfilled.

Along the time of free market approach, removal of ceilings on ownership of land holdings has been given special attention. It is supported by the argument that larger scale corporate, capitalist agriculture is more efficient than the individual peasant - farming prevalent in the country.⁴ It lead to better allocative efficiency, inducing higher private investment in agriculture. Hence it results in higher outputs, higher income and higher exports. However new agricultural economist like U.S. Vyas and C.H. Hanumanth¹⁹ Rao favour removal of Ceilings. - Vyas argues that there is no conclusive evidence of land productivity rising with increasing farm size. Hanumanth Rao supports the increasing of farm sizes only at the small and marginal farmer's level by the term credit through land development banks. This would increase the land size holdings without encouraging capitalistic farming at the lower end. After strategy should emphasize upon the protection of ownership right of the small and marginal farmers. Keeping the controversy regarding the land holding's ceiling apart. A well organised liberal land lease market with property

right fully protected in law would provide security to rural poor. They would be able to increase their farm size, through appropriate credit facility. In this way the objective of allocatively efficiency and higher private investment could be realised even with the introduction of ceilings on ownership of land holdings. Moreover the institutional management should also ascertain that the nature of tenancy may not change from the feudal type to capitalist type so that the fear of weak farmers leasing out land to the land lords may be removed.

As it has been observed that in india, the diversification of agriculture has been taking place in the rainfed areas. Cropping pattern has shifted from traditional food crops to dairy, livestock raising horticulture and plantation. The agricultural research and development should also shift from earlier crops to these commercial commodities. Apart from providing high value products and hence higher income. This kind of shifting also accelerates the quality and level of employment. This fact is supported by a survey based analysis by Ramesh Chand and Salti. Moreover this type of diversification increases the earning of foreign currency by increasing the volume of our exports. That is these product are employment oriented as well as export oriented. Hence diversification should be given special emphasis in our new agricultural strategy.

There are large potentialities in crop diversification and exports. In the process of agricultural labour and crop diversification small and marginal farmer's involvement is a pre condition for realising the multiple gains arising from it. Appropriate strategy should be devised by our policy makers, in this regard so that the rural poor's contribution towards this many sided diversification may not be underestimated. This will consequently enable the lower agricultural class to avail of the benefits of increasing growth, agricultural diversification, higher export and rapidly rising income. This involvement can be facilitated through institutional credit flow at reduced rates of interest to agricultural classes.

The demographic pressure on agriculture have to be reduced in order to increase

labour productivity further. This demand labour force diversification when labour productivity increases as the same quantity of output could be produced with lesser labours resulting in shifting of Agricultural labourers to non-agricultural sector thereby increasing income and employment at macro level. An important policy intervention is to encourage diversification in agriculture and other allied activities. Moreover heavy investment in the development of agro processing and related industries is necessitated.

In the coming years, India would be able to increase the volume of agricultural exports as a result of withdrawal of agricultural subsidies by the developed countries under the tariffs and trade agreement. With the expected withdrawal of agricultural subsidies by the developed countries subsequent to the signing of tariffs and trade agreement, India has the opportunity to increase its agricultural trade particularly in agro processed commodities. This could further increase the volume of employment in agro processing and other allied agricultural activities. The new agricultural strategy ought to invest in research and development, manufacture and exports of agricultural products.

2.1.6 Recent Changes in Agricultural Policy

Since 1961 till now there has been comprehensive agrarian reforms to accomplish the desired objectives. The importance of agriculture in terms of productivity and employment had increased with the on set of new technology. Broadly we include in agricultural policy different sub-sector of agriculture like agricultural price policy, land reforms policy, irrigation policy, Agricultural research and development policy, employment and labour productivity, agricultural market policy, public distribution system, wages and rent policy, Agricultural credit policy, Public and private investments in agriculture, Agricultural diversification policy etc. Agrarian changes, during post independence period brought about significant changes in the agrarian social structure.

Land reforms policy is still a matter of controversy. Many questions arise relating to recent changes in land reforms system as to what extent concentration of land has been

reduced in response to the abolition of Zamindari system after independence ? How these changes have benefitted the small and marginal farmers? and finally which categories of holdings, whether small size or large size have emerged comparatively better off? The study of changing land distribution system is therefore of great socio economic importance in developing agrarian economies like India?

If the concentration of land is growing in favour of lower agricultural class, then measures have to adopted to make their holdings more viable economically by ensuring cheap and subsidised inputs. But if this concentration is becoming more pronounced at the level of medium holdings, policy measures, such as lowering of ceilings, rationalisation of the policy of subsidising inputs should be emphasized. Despite a considerable decline in the proportion of area owned by the large farmers inequality has not been significantly reduced. Land concentration has been found at the middle level. Small and marginal farmers have not gained much from land distribution policy. At the top of the land ownership hierarchy though proportion of land has declined still a majority of rural households at the bottom of land ownership hierarchy have largely remained unaffected in the process of changing agrarian policies. In so far as the implementation of land ceiling laws is concerned, it needs to be reformulated.

We have to modify the existing land distribution policy. Simply, the implementation of traditional land ceiling laws are not sufficient for proper growth. Land ceiling laws should be accompanied by other substitutional reforms like provision of complementary inputs like seeds and fertilizers, cheap and adequate credit, promotion of agriculture related enterprises like dairy and pisciculture, cooperation among small and uneconomic holdings. If necessary action is not taken in this regard, then such policy may not only be unable to reduce rural poverty but also may influence production adversely in the coming years. In poor agrarian economies, where the institution of tenancy is more pronounced, actual yard stick of economic growth is better indicated by the distribution of household operational holdings. Changes in the distribution of households operational holdings indicate not only

the level of resources of different categories of households but also their share in the gains from agricultural development. Therefore while formulating land reform, it is extremely important to examine the temporal changes in the distribution of operational holdings. We find that concentration of land owned at different levels of land ownership hierarchy since 1961 has removed more or less the same increase of bottom 40 percent of the households. Whereas middle agricultural households reflected an increase in the concentration of land holdings to the extent of 70 percent. However we find a fairly noticeable decline in the top concentration at different levels such as 1 percent, 5 percent and 10 percent across the states among the land owning categories, the predominance of large holdings declined significantly both in terms of their numbers and acreage owned, whereas marginal holdings (less than 1 acre) showed a fairly significant increase accompanied by lower units of land than before. Thus the importance of large holdings declined both in terms of their number and acreage operated whereas sub marginal holdings witnessed a remarkable weightage since 1961.

Broad policy changes have been brought about recently in the supply side factors like crop and labour diversification public and private investment, irrigation, fertilizers growth pattern, labour efficiency land and labour productivity, infrastructure, Agriculture research and development, credit reforms, Agrarian reforms, development and modernisation of technology etc.

A major reform in the supply side factors is needed for achieving the goal of accelerated and sustainable growth of Indian Agriculture, because the supply side factors like technology, fertilizers, irrigation, credit and other agricultural infrastructure raise aggregate supply response and are the primary factors behind accelerated and sustainable growth of Indian Agriculture. India can benefit from the changing economic scene domestically as well as internationally by accelerating the growth of its agricultural sector providing momentum to the overall growth of the economy. Agricultural policy changes may lead to greater employment, regional and sectoral equity and faster poverty reduction

along with efficient use of resources. Our emphasis should be in reviewing the Agricultural policy so as to make the terms of trade favourable to agriculture.

Agricultural research and growth centres should be met with more investment than before so that needed institutional reforms in the research system may be carried out. It should be made more flexible, and reserachers should be encouraged to work with prive sector companies engaged in reserach and seed distribution. A review of the regional research system is necessary to ensure location specific research and to strengthen communication to the farmers. Adequate human resource property is necessary to encourage private research. The recommended tehcnology policies need to be evaluated not only from the point of view of farmers security but also from the angle of social perspectives of efficiency and sustainability.

Irrigation sector should be institutionally reformed. Financial autonomy should be granted to irrigation departments on the condition that they recover the operation and management expenses from beneficiaries. Irrigation policy need to be formed priority wise. The highest priority should be given to maintain the existing irrigation facilities. Therefore rest of the irrigation potential in the country may be developed. This in turn demands stepping up of rate of investment in this sector so that the projects already undertake may be completed timely. Fertilizer efficiency can be better promoted through development of irrigation. We mean to say that though production may increase with balanced use of nutrients like Nitrogen, Phosphorous and Potassium but in the absence of inadequate investment in irrigation it will not show remarkable results, therefore a policy measures have to be adopted to believe the ultimate irrigation potential of the country. So far we have 82 million hectrares of land under irrigation, indicating that more investment funds should be allocated to major and medium irrigation schemes. Apart from private expenditure, government expenditure on irrigation sector needs to be enhanced.

In terms of policy response to the questions regarding the government investment,

institutional reforms in major and medium irrigation schemes and efficiency in grand water use, the highest priority should be given, first, to develop the existing irrigation potential and completing the major and medium water projects already at hand and then to spread new schemes and developing the rest of the irrigation potential in the country. Appropriate pricing policy should be adopted in order to reduce the wastage of ground water, because major private pricing of electricity encourages excessive pumping. Moreover privatisation of power generation should also be accompanied by privatisation of power distribution. We conclude that privatisation of power distribution is more important than privatisation of power generation.

Conclusion

Policy changes at the macro level may create much better incentive environment for agriculture by increasing the growth rate of food grains production further. Here it should be pointed out that despite an increase in foodgrains production, this decline may be attributed to a significant decline in the per capita consumption of foodgrains in agriculturally developed states accompanied by a higher percapita income growth rate. Availability of food articles other than foodgrains may also be a factor behind this decline. Even after reduction in subsidies agricultural exports may improve incentives by raising producer's prices. This would also help in the better utilization of India's Agricultural resources which are comparatively better than many other countries. Thus India will also be so benefitted on the basis of comparative advantage along with division and specialisation of human, land and labour resources. Thus opening up of agricultural trade needs to be seen as an opportunity for exploiting India's comparative advantage in Agriculture thereby raising the overall economic growth rate by improving the efficiency of resource use in agriculture. Not only restrictions on exports be removed but also inter regional movement of foodgrains need to be encouraged so as to provide incentives for region wise crop specialisation resulting in maximum possible efficient use of resources. Lowering of cost of production crops of through developed technology should be given a higher priority than protecting the prices

of crops.

Our credit policy suffers from serious defaults on the part of those who have the capability to repay. This is due to the lack of professional approach and necessary follow up in lending. Though credit for agriculture has to expand at a faster rate than before because of the need to step up agricultural growth to generate surpluses for exports, but the rising overdose and management inefficiency should be checked. The economic viability of credit institutions must be improved. Larger farmers take a major proportion of credit at concessional rate of interest and in turn lend it to poor farmers at a high rate of interest. Thus there exists a large difference between the institutional rate of interest and market rate of interest. The existing large differential between the concessional rates of interest charged by insitutional sources and high market rates is responsible for rent seeking by the middle level agriculturists (rich farmers). Small and marginal farmers may be benefitted more from easier and timely availability of credit directly from insitutional sources than from low subsidised rate of interest charged which leads to recycling of credit and encourages the large farmers to work as middle men. Such concessional lending not only disturbs the economic viability of credit institution but it also violates the norms of equity of serving a small number of big borrowers and neglecting the large number needy (small) borrowers. Therefore improving the economic viability of credit institutions by phasing out these concessional rates of interest, should be given high priority on the policy agenda..

The intensity of fertilizer use has gone very high from 3 kilograms per hectare in 1960s to 7.5 kilograms per hectare in 1995. Proportion of land fertilized has been much higher in case of irrigated land than unirrigated land but still irrigated rainfed differential in fertilizer has quite narrowed down. The policy changed regarding the removal of fertilizer subsidies arising from the problem of subsidies burden of the central budget. However any policy change in this respect should work towards the realisation of long term objectives rather than short term objectives. Fertilizer was used in more than 90 percent of irrigated land and about 55 percent of unirrigated land by 1995. Though area covered under irrigated

land has been much higher than rainfed land, still the growth rate of diffusion in the irrigated land was much higher as it has increased from 10 percent in 1961 to about 55 percent in 1995. The strategy points out that the rate of fertilizer use is lower in case of small farmers than large farmers but the quantity of fertilizer use by farmers of low means belonging to the category of poor farmers is higher than large farmers. Its reason may be that those small farmers use high doses of fertilizers in order to improve the quality of their unirrigated plots. Large farmers on account of higher investment in minor irrigation need not use such high doses of fertilizer as the small farmers use on their unirrigated or partially irrigated small farms. It is observed that the rate of adoption of fertilizers use is somewhat lower among small farmers than large farmers owing mainly to credit constraints, but those small farmers who do adopt fertilization use higher doses of fertilizers. These findings suggests some policy implications. Fertilizer consumption has become more sensitive to its real price because fertilizer response is lower at higher levels of consumption area. Fertilizer use should be considerably promoted in those areas which have been using very low doses of fertilizer. Fertilizer subsidy should be provided only in low consumption areas and high response crops and these savings from reduced fertilizer subsidy should be invested in basic agricultural infrastructure.

An ideal and efficient system of infrastructures on both input and output side is important from the point of view of yield based growth of Indian agriculture. Future growth of Indian agriculture requires intensive use of inputs. On the input front it helps in ensuring timely and adequate delivery to farmers and consequently leads to better supply response. Once the supply has been raised, Agricultural infrastructures on output helps in integrating local markets with national and international markets. Thus the Indian farmers can be benefitted from comparative advantage opened to them in various crops. A thorough study of rural farmer's problems relating to their social, economic and physical aspects is necessary to ensure a planned system of roads, markets, houses and other services for high return oriented agricultural development. While formulating infrastructural policy only local user graph

like social and marginal farmers, traders, skilled and unskilled laborers and workers of non-governmental organizations should be targetted. Decentralisation in buildings, operating and maintaining different components of infrastructures with the help of local people is a desirable policy direction for achieving the long term objective.

2.2 Pattern of Industrial growth in India

2.2.1 Structural Changes in Indian Industry

The Industrial policy resolution of 1948 was the first document to provide insight as how the industrial structure was to evolve over a period of time. The resolution divided the Industries into four broad categories and retained defence production, atomic energy and railway under the exclusive control of the central government. This resolution provided a limited area of operation of the state in the Industrial sector. A second Industrial policy resolution was adopted in April 1956, which extended the area of government ownership and control. The new resolution classified the Industries under three schedules. Schedule A included seventeen Industries under the exclusive control of the state. Schedule B comprised twelve Industries which were to be owned by state but not exclusively that is these were to be supplemented by the role of private enterprises. Schedule C represented the remaining Industries which were to be owned and controlled exclusively by the private sector. The 1948 resolution provided a limited area of operation of the state in the Industrial sector, but was uncertain of the areas where private sector would be established. In the light of the experience gained during the first plan and in the context of large public investments, a second Industrial policy resolution was adopted in April 1956. This second resolution was a reflection of the economic diversification envisaged as part of the strategy of development. The Industrialisation strategy was evolved as state owned, state controlled and state directed in almost all the plans after 1956 upto the end of the eighties. The public sector's outlay was the main indicator of the Industrialisation. As a part of industrialisation strategy and in support of it, the Industrial licensing mechanism was evolved and strengthened over time till the early seventies. The fundamental basis for Industrial licensing was provided by the Industries Act 1951, which prescribed that all Industrial units which employ 100 or more worker and were having fixed assets of Rs. 10 lakh or above should obtain licenses before being established for undertaking substantial expansion of their existing plants.

The principal conclusion that emerges from the analysis of structural changes in Indian Industry is that there was a tendency in the early 1980s from a high positive rate of growth trend in productivity to a significant negative rate, a result contrary to Aluwalia's (1991) conclusion, based on deflating value added only by the output price, that the trend shift was from negative to positive productivity growth. This is evident from the graph relating to trend in Industrial output from 1980-81 to 1997-98. A major purpose has been tried to be solved through the observation of Industrial productivity trend. The disaggregated segregated productivity measures have been suitable device to provide a reliable measure of productivity for Indian manufacturing. If the disaggregation attempted itself of a very low order, then it is arguable that the bias introduced by the use of unfarm outputs and the material price indices would also be of low order. The strong trend shifts in the material to output price relative during our period render such current price trends and comparisons of capital intensities is highly misleading. Our results are broadly in conformity with the conclusion of Balkrishna and Pushpangadan (1994). Although their measure of productivity growth, based on separately deflating outputs and material inputs by their respective price indices also suffers from significant measurement bias. It is not possible at the present juncture to attribute changes in Industrial growth strategy to the operation of free market forces because these reforms are only a few years old and have been implemented after 40 years of active state intervention.

Here, some of the possible demand and supply side factors have been attempted behind the trend in Industrial growth. The economic survey 1995-96 shows that the Industrial growth during 1975-1995 have been very impressive. It shows that the capital goods sector has growth at 27.5 percent during 1994 and 14.5 percent during 1995. The fact is that the industrial growth had started with the bottom in the early 1990s and is growing from a low base. The upward and down-ward movements in Industrial expenditure during the high growth period of 1980s, stagnation in late 1980s and early 1990s and the recent rate of growth have been analysed. If we correlate the trends in government expenditure and industrial outputs,

there is almost one of the positive correspondence. For the period 1981-82 to 1996-97 the correlation coefficient of government expenditure with capital goods is 0.94, with basic industries production is 0.944 and with consumer goods is 0.95. The correlation coefficient of government consumption expenditure with capital goods is 0.96, with basic industries outputs is 0.97 and with consumer goods is 0.98. It is quite obvious that government expenditure and Industrial growth seems to be going together. If the increase in government expenditure is taken as a part of the reforms, then one can agree with the present rate of increase. The basic stimulus to growth, according to the market reforms comes through supply side efficient utilization of resources. A free market economy is expected to lead to efficient utilisation by competitive operation of markets. Market reforms affect in general equilibrium terms across sectors, may reduce some prices, and increase some other prices as past policy intervention was supposed to have generated allocative inefficiency. If import of manufactured goods are liberalised, process of several manufactured goods including capital goods as well as consumer goods, will go down. This will have implications for money and real incomes. This may lead to a reduction in excess profit of producers and also reduction in employment of the protected manufactured sector. On the other hand the income and possibly employment in the sector whose output prices may increase, changes in real income depend on the basket of consumption of these goods across different income groups.

Table - 1

Growth in Industrial Production

Plan/Year	Growth over previous year (percent)			
	Mining and Quarrying	Manufacturing	Electricity	General
First Plan	1.9	6.8	9.8	6.5
1956-57	0.1	8.8	7.2	7.9
1957-58	2.9	1.5	5.1	4.8

1958-59	-1.5	4.0	8.9	3.6
1959-60	5.5	10.9	13.8	10.5
1960-61	2.8	9.0	13.8	8.6
Second Plan	7.5	7.1	14.1	7.3
1956-57	4.6	8.6	12.2	8.4
1957-58	9.5	2.7	13.0	3.6
1958-59	5.6	2.8	14.9	3.5
1959-60	6.1	10.6	17.4	10.5
1960-61	11.7	11.1	12.9	11.3
Third Plan	5.5	8.2	13.5	8.2
1961-62	1.2	8.5	16.1	8.2
1962-63	13.0	9.1	11.7	9.5
1963-64	2.9	9.5	17.4	9.2
1964-65	-1.3	9.5	11.8	8.8
1965-66	11.5	4.4	10.3	5.3
Plan/Year	Growth over previous year (percent)			
	Mining and Quarrying	Manufacturing	Electricity	General
Fourth Plan	2.1	3.7	7.6	4.2
1969-70	3.9	6.1	14.2	7.3
1970-71	-1.1	2.2	8.6	3.1
1971-72	2.5	5.4	8.7	5.7
1972-73	4.3	3.8	4.8	3.9
1973-74	0.8	0.8	1.6	0.8
Fifth Plan				
1974-75	10.5	1.8	7.7	3.2
1975-76	11.6	5.6	14.8	7.2
1976-77	4.2	10.0	11.7	9.6

1977-78	2.5	3.3	3.2	3.3
1978-79	2.0	7.6	12.1	7.6
Annual Plan				
1979-80	0.7	-2.1	2.1	-1.4
Sixth Plan	11.0	5.3	8.3	6.4
1980-81	4.3	3.7	5.	4.0
1981-82	17.7	7.9	10.8	9.3
1982-83	12.4	1.3	5.7	3.2
1983-84	11.8	5.7	7.6	6.7
1984-85	8.8	8.0	12.0	8.6
Seventh Plan	5.6	8.9	9.4	8.5
1985-86	4.1	9.7	8.5	8.7
1986-87	6.2	9.4	10.3	9.2
1987-88	3.7	7.9	7.6	7.3
1988-89	7.9	8.7	9.5	8.7
1989-90	6.3	8.6	10.9	8.6
Annual Plan	2.6	4.1	8.2	4.4
1990-91	4.5	8.9	7.8	8.2
1991-92	0.6	-0.8	8.5	0.6

Plan/Year	Growth over previous year (percent)			
	Mining and Quarrying	Manufacturing	Electricity	General
Eighth Plan	4.1	7.9	6.6	7.3
1992-93	0.6	2.2	5.0	2.3
1993-94	3.5	6.1	7.5	6.0
1994-95	7.5	9.8	8.5	9.4
1995-96	7.4	13.0	8.1	11.6

Source : 1. Central Statistical Organisation

2. Chana, J. M. (1989) : Configuration of Industrial growth in the context of Indian Planning.

From Table I relating to structural growth in Industrial production we see that mining and quarrying achieved highest growth rate in sixth plan period to the extent of an average of 11 percent over their respective previous years. The Industrial sub sector namely manufacturing labelled a growth rate of 8.2 percent in the 3rd plan which seems to be highest in all the give year plan years till now. Electricity gave the best performance in the second five year plan period in terms of growth rate over previous years. Industrial sector as a whole established the highest growth rate in the third plan period to the extent of 8.2 percent which is same as that of the manufacturing sector taken exclusively in the same plan period. But this growth rate of sub sector cannot be intermingled with the overall structural development of Industrial sector. Percentage growth rate of Industrial sub sectors or Industrial sector as a whole is not the yard stick of complete Industrial development or total Industrial production as a share of national Income.

The growth of manufacturing production which came down during mid sixties particularly in the year 1966-67 which was marked by negative growth rate (-2%) and recovered only after the mid seventies. The causes for the slow down in Industrial growth rate have been searched. Stoppage of the project aid during the mid sixties, the steep rise in defence expenditure, the slow down in the annual rate of rise in public investment, the adverse terms of trade against manufacturers vis-a-vis agricultural goods, the slow down of agricultural growth itself; all these factors seems to be responsible for the slow down in the growth rate of manufacturing specially during mid sixties. But there is no dispute that after the mid seventies the Industrial growth rate seems to have picked up though the target of 8 percent annual growth rate still seems to be difficult to be realised.

Table - II

Output and Input (Public Manufacturing : 1973-74 to 1996-97)

Impact of agriculture on Industry

Year capital	Value of output	Net Value added	Description	Material input	Emoluments	No. of employees	P r o d u c t i v e
	(Rs. lakhs)	(Rs. lakhs)	(Rs. lakhs)	(Rs. lakhs)	(Rs. lakhs)		(Rs. Lakhs)
1973-74	222239	67386	14131	140077	48038	87600	4.3483
1974-75	347723	95427	15686	236520	63350	917083	428648
1975-76	467780	111598	22730	339860	74482	1005878	5.7586
1976-77	553947	135358	30398	394718	80937	1059646	635710
1977-78	630180	134242	34211	462222	88676	1107875	671938
1978-79	778388	166514	45556	573789	105059	1323939	819285
1979-80	953822	187787	48590	717445	125437	1312855	901854
1980-81	1148795	199819	58547	890429	141329	1353619	916149
1981-82	1524635	288170	59346	1177120	164436	1420134	955956
1982-83	1867291	340475	60792	1466023	192824	1456422	953895
1983-84	1907036	326126	82735	1498175	231122	1464369	984883
1984-85	2336565	383232	101906	1851427	286005	1612355	1129326
1985-86	2714763	487507	120043	2107213	280468	1465812	1034926
1986-87	2753171	458261	111889	2183022	308933	1416241	1017276

Year	Value of output (Rs. lakhs)	Net Value added (Rs. lakhs)	Description (Rs. lakhs)	Material input (Rs. lakhs)	Emoluments (Rs. lakhs)	No. of employees	Productive capital (Rs. Lakhs)
1987-88	3110333	579250	131289	2399794	348967	1434270	1114100
1988-89	3965952	733081	157023	3075850	405696	1539072	963808
1989-90	4166324	736430	155982	3273910	411716	1282328	1001650
1990-91	5336626	1008745	219562	4108320	498178	1493932	1448983
1991-92	420531	742765	219284	3318485	479584	1399072	1294663
1992-93	6119223	1138841	287197	4693187	666360	1601144	1497241
1993-94	5336871	1238942	298297	4898760	685350	1573671	1113576
1994-95	6992333	1000875	269274	3779865	699760	1583001	1008767
1995-96	7333301	1345876	297737	4781653	700132	1677860	1447286
1996-97	7999565	1438001	301113	5019863	722235	1699872	1499931

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Source : Productivity and growth of Indian manufacturing (1997) Oxford University Press, New Delhi.

The registered manufacturing is not the dominant element in the modern segment of the Indian economy or what in our national accounts is referred to as the organised sector. In 1983-84, net value added in registered manufacturing accounted for only a little over 28 percent of the total net value added in the organized sector of the Indian economy. Even if we include mining and quarrying, electricity, gas and water, the share of the so extended manufacturing sector was only 40 percent. It is the organised services (including public administration and defence) over the organised construction which together accounted for 48 percent of the organised sector value added. This is also reflected in the composition of the organised sector work force. In urban India, which accounted for about 5.8 percent of the total organised sector work force, roughly two third of the urban organised sector work force was in services other than construction.

2.2.2 Absorption and productivity of labour in Industrial sector

The growth of Indian industrial sector depends largely on productivity of labour. It also depends upon the substitution possibilities between labour and capital. It has been found that capital and labour rates has been very high in Indian Industrial sector particularly the manufacturing sector. Manufacturing sector has been playing a vital role in the process of industrial development of the Indian economy, Indian economy has a large endowment of human resources. Our purpose is to search out the ways through which we could replace the capital intensive techniques of production by the more labour intensive techniques of production in the Industrial sector. A study of possibilities of substitution between capital and labour is necessary in the Indian manufacturing sector. Empirical studies have to be done on the possibilities of substitution between capital and labour with a view to generate empirical information for policy makers.

The structure of labour absorption in Indian economy has also shifted but at a rather slow pace as a result of shifting of sectoral contribution to the total national income. We have to see the shifting of labour from agricultural sector to the Industrial and services sector. In an industrialised economy we may expect the following types of changes.

1. The percentage of the population dependent on Industry particularly the manufacturing sector should increase over a period of time.
2. The increase in manufacturing employment should absorb at least a major part of the population released from agriculture.
3. Within manufacturing a shift employed labour in the Industrial sector have come down from 7.99 percent to 7.23 percent, in terms of the sectoral comparison also. Instead of increasing the secondary sector has witnessed a decline in the rural areas. As regard the sectoral composition of urban employment, the percentage of workers in the manufacturing sector has shown a decline.

In order to analyse the absorption and productivity of labour in Industrial sector, we have divided the industries into three sub sector's namely public sector, private large industrial sector and small manufacturing sector . The given Table II shows the labour to value added ratios for the three sub sectors of Indian industries. The small sector had higher capital intensity throughout. Similarly the public sector was considerably more capital intensive than the private large sector although the capital intensity of the public sector has narrowed down to the same extent and has become more labour intensive than before in case of public and private large sectors. Through the late 1970s, capital intensity fell in the private large sector but rose in the public sector. But when we compare the public sector and private large sector in the 1980s, we observe that it rose in the private large sector but fell in the public sector. These differences underline the need for disaggregation of total productivity measures. The strong trend shifts in the material to output price render current price trends. We observe that the rise in real capital productivity during late 1970s and early 1980s was sharper. The real capital productivity was considerably greater in the private large sector than in the small sector. Capital intensity shows greater fluctuations in the public than in the private sector. The public sector did not experience any noticeable rise in capital productivity until the early 1980s when it saw a rather steep rise. Following significant fluctuations between 1981-

82 and 1989-90, the public sector registered a steeper fall in capital productivity than the private sector. It was basically due to the cumulative and current effects of liberalisation.

In the labour market there are division of labour in broader categories of manufacturing among the small public and private large sectors. Industrial labour market tends to give birth to heterogeneity with in the organised segment of Indian manufacturing. We can say that a major source of heterogeneity arises from systematic segmentation in the factor markets. In the labour market, there are two aspects to this segmentation; valuable skill composition and variable wages for the same skills. Average skill levels are higher in the public and private large sector than in the small sectors. These differences in the level of labour skill reflects differences in human capital.

Labour productivity has increased considerably in all the three sub sectors showing better mental and physical efficiency of human capital. The given table indicates that much of this increase occurred by the year 1982-83. The fall in labour intensity was steepest for the private large sector and considerably lower for the public sector. It is observed that the significant gains in productivity assured via reductions in material inputs, capital and labour intensities in the 1970s.

2.2.3 Impact of Agriculture on Industry

As agriculture develops more and more; the consumption demand of farmers for industrial goods expands and stimulates the growth of the non-farm sector¹⁴. A growth in agricultural Income via growth of agricultural land and labour productivity, leads to a growth in the consumption demand for labour intensive non - farm goods. Thus agricultural development precedes industrial development. The growth of the labour - intensive rural industrial sector has proved as a means to minimise the problem of rural unemployment. It is in this context that the intersectoral linkages of agriculture and industry assumes importance alongwith the adoption of New technology. Agricultural growth of the rate of above 4 percent per annum can hardly make any improvement in the existing level of unemployment and

underemployment, unskilled and the rural non farm sector resources should be considerably developed. There it becomes important to develop inter sectoral linkages between agriculture and Industry. The logical indispensability of the growth forces leading to the formation of an agriculture - Industry nexus was discovered by the classic economist in the light of institutional changes in the organisation structure that took place in the late 18th and early 19th centuries in England. The process of growth became dynamic when capital started moving freely from agriculture to industry and surplus agricultural labour began to move to industry with the surplus food from agriculture.

In India Agriculture contributes one third of the Industrial raw materials. Moreover agricultural exports earn foreign exchange which facilitates import of capital goods, machinery and spare parts for expanding Industrial base¹⁵. Many export items are dependent on the performance of agriculture and the performance of agriculture greatly determines the level of economic activities in other sectors of the economy. The performance of agro-based industries is linked with the development of agriculture. The agro based Industries are being used to promote employment opportunities to the surplus labourers. Thus the growth in agriculture is naturally dependent on increase in the production of agricultural input industries. Both the agricultural and industrial sectors have other interrelations at the level of demand and supply.

Of the total Intermediate use of the outputs of manufacturing sector, agriculture shares about 6.6 percent. However the share of agriculture is about 15 percent of the total agricultural growth. It helps industrial development from both demand and supply sides. On the demand side, it shares the inputs use of the manufacturing units and on the supply side it provides the raw materials. The input structure in agriculture shows that agriculture consumed about 42 percent of the input generated by itself and the manufacturing sector supplied about 17.5 percent. We conclude that the dependence of the manufacturing sector on agriculture is heavier than the dependence of agriculture on manufacturing units¹⁶. The agro based Industries are heavily dependent on agriculture for their raw material supply and thus the development

of agriculture is directly linked with the performance of agrobased industries. The rapid progress in the agricultural sector of our economy in the recent past has resulted in the expansion of the industries which manufacture agricultural inputs and the industries relating to horticulture, live stock, and other such products etc. On the whole, in the matter of employment, production, income, distribution, consumption, adoption of new technology etc., growth of agriculture has assumed major importance.

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3. Agriculture-Industry relationship in Indian Economy

The significance of Agriculture-Industry relationship arises from the fact that agriculture still plays a dominant role in the Indian economy without which, the Industrial sector cannot grow at a desired rate. There is a need for better and close collaboration between Industry and agriculture. It is primarily in the interest of industry itself to see that agriculture grows. The relationship between the two sectors is complementary but it has been observed that it weighs more in favour of agriculture¹. For developing agriculture on modern lines and for bringing in new technologies, new marketing management, new organizational structure, new developing pattern and new cropping technique will have to be introduced. Industries can adopt some of the areas or villages situated around their location and help in the development of infrastructure required for agricultural development in those areas. There can be no sustained development of agriculture, if the other sectors of the economy do not grow and absorb the products of agriculture in large quantities. The growth of agriculture, therefore, sustains a certain level of growth in the general economy and there is a direct relationship between Agriculture and Industry. If Industry is to develop, it needs raw materials, primarily of agricultural origin, to feed it. Labour force has often to come from the rural sector. The demand for agricultural products thus created and the withdrawal of surplus manpower from the rural areas is itself the contributory factor to the progress of agriculture. Thus in the early stages of economic growth, agricultural development may provide the necessary capital for Industrial progress, particularly in countries with a predominantly agricultural economy, like India. The Industrial revolution in Europe would not have been possible without agricultural revolution having preceded it. The complementary aspects of agriculture and Industry if pushed through with deliberate process and planning with a definite policy, we may achieve agro-industrial interaction. When we talk about

Agriculture-Industry inter relationship, it refers to two types of inter relationship. Firstly functional and secondly spatial. In India, taking into account, the current trends in Industry and agriculture governing its policies and programs, government has to maintain an adjusted balance between the priorities in relation to the potentialities of primary and secondary sectors which yields a higher possible rate of growth. Agricultural advancement is practically impossible unless it is paralleled by Industrial advance utilising local natural resources.

Not only agriculture plays an important role in Industrial development, but Industrial development too provides infrastructural facilities for the development of agriculture. Agriculture receives materials and equipment for modernisation and raising production and productivity per hectare and per labour. There is a direct link between agricultural income and Industrial development. Agriculture offers a wide market for the sale of Industrial products. When Agricultural income goes down, it directly affects demand for manufactures and its further expansion is obstructed. So increased agricultural income directly affects the growth of the non-farm output and employment. On the other hand Industrial sector facilitates the growth of agriculture on modern lines by providing modernised materials and equipments along with advanced technology oriented infrastructures. Thus we conclude that the agricultural sector and Industrial sector are mutually interdependent.

Prof. Kuznets² had shown conclusively that there is a positive relationship between the growth of the per capita GDP and share of the Industrial sector while it is negative in the case of agricultural sector and somewhat positive in the case of the services sector. The quickest way of demonstrating the truth of the formulation was by a cross-section analysis of the gross domestic production at factor cost for many developed and developing countries. When we look at the share of the three sectors (Agriculture and allied, Manufacturing and services) in a particular year we come to conclude the above said relationship between agricultural and Industrial sectors. Empirical analysis shows a strong positive relationship between the growth of the per capita Income and the sectoral share of the Industry and conversely a declining sectorial share of agriculture, the difference in percentage points

between the highest group coverage of per capita GDP of 1382 dollars and the lowest of 52 dollars, being plus 31.7 points in the case of the agricultural sector. Agriculture has lost its percentage not only to Industry but also to services though by a smaller measure.

Here, it should be pointed out that the nature of Industry is not the same between the developed and the developing countries, the former representing the use of advanced technology and the latter using backward technology, including historically inherited traditional technologies. Thus, economic growth involves not only an increased role of sectoral shares of the Industrial sector but also the use of modern or advanced technology in its operations. In fact, technology is an all-impressive factor in economic growth and covers not only industry but also Agriculture and services. And it seems that advancement in the technology use rather than a mere percentage increase in the sectoral share of the Industrial sector is the key to rapid economic growth. In recent year specially in the late 80's and 90's, the use of better technology and higher investment in agriculture in some of the developing countries is becoming a notable feature of their economic growth as in the case of India the past several decades of development have demonstrated that growth in agricultural production and productivity in India can match or surpass the growth in Industrial countries. The record has shown that agriculture can be dynamic sector in India and constitute greatly to growth in real incomes, employment and foreign exchange earnings towards the alleviation of poverty. Thus agriculture is still a dynamic sector in the economic growth of India but this does not mean that it can take the place of Industry in maximising the growth of the GDP. It is the role of better technology and supporting investment for its use that has made the difference to the agricultural sector and the same would be even more true for the Industry and the services sector³.

The major problem confronting India is that of the large lag between the fall in the share of the labour force and that of the GDP of the Agricultural sector. This leads to a variety of adverse consequences, such as fall in the productivity of the labour force engaged in agriculture in spite of use of modern technology underemployment and unemployment

specially in rural areas and increasing slum areas alongwith urban deterioration. The growth of the Industrial sector share doesn't by itself either bring about a significant increase in economic growth nor does the fall in the share of Agricultural sector reflects a surplus of food or other agricultural products. Merely export oriented agricultural growth in food grains and raw materials cannot solve the problem. Agricultural exports may help if they are in new areas accompanied by high economic value such as vegetables, flowers, fruits and processed foods. Similarly Industrial production for exports may help if they cater to the changing tastes of the paying markets and are based on competitive technology and skilled labour.

The performance of agro based Industries is linked with the development of agriculture. The agro-based Industries are being used to promote employment opportunities to the surplus labourers. Thus, the growth in Agriculture is also dependent on an increase in the production of agricultural input Industries(because it serves the purpose of growth of both the sectors). Both the agricultural and Industrial sectors have close inter relations at the level of demand and supply. Theoretically many inter relations between agriculture and manufacturing sectors could be assigned through technological inovations and structural changes, Institutional behaviour and input-output analysis. In developing economy like India, the process of countries readjustment of agriculture and other sectors becomes necessary. The Industrial sector which is predominantly the consumer of agricultural output have to readjust and change its production pattern in order to include in its product wise resource such as fertilizers, pesticides, modernised machinery and their spare parts etc. The rapid progress in the agricultural sector of our economy during 1980's and 1990's have resulted in the expansion of the Industries involved in the processing of preservation of agricultural input and Industries involved in the processing of preservation of agricultural, horticultural, livestock, forest products etc. The economy has thus begin to develop intersectorally with interaction and reinforced the process of overall growth of the economy. As far as production, income, distribution, consumption is concerned, adoption of modern technology is of great concern for our country. The development of agriculture also depends on the relative prices of inputs

and output⁴. Due to sensitive behaviour and significant place of agricultural prices, it is an imperative need to examine the factors affecting the prices of food grains and the manufacturing sector. In market economies where the price system is considered as an appropriate mechanism for achieving a desirable allocation of resources, price policy has an important role to play which has multidimensional effect on employment, income distribution, consumption, production, adoption of new technology. Prices play an important role at every stage of the functioning of the economy from production through exchange to consumption changes. The agricultural prices also affects the transfer of Income between agricultural and non-agricultural sectors of the economy. It has been observed that money supply has been the significant variable positively affecting the price level of manufactured goods in the pre green revolution period as well as in the post green revolution period. It is seen that the money consistently influenced positively the prices of food grains, but on the other hand, neither the per capita nor availability of food grains nor the total food grains production affected the prices of food grains 40 percent to 95 percent price valuation in case of Industrial goods are explained by Industrial production and money supply. This price variation of manufactured goods are explained with the combined effect⁵ of independent variables to the extent of 40 percent to 95 percent in the pre-green revolution period whereas in the Post green revolution period, this variation in the prices of Industrial goods is explained by 20 percent to 40 percent with the increase in irrigated area⁵.

Table-I

**Growth Rates (Agricultural Sector, Industrial and Services Sector) for the Normal Periods
and the Crises years (57-58, 65-66, 72-73, 79-80 and 91-92)**

Sector/periods	1950-51 to 56-57	57-58	1958-59 to 64-65	65-66	1966-67 to 71-72	72-73	1973-74 to 78-79	79-80	80-81 to 90-91	91-92	1992-93 to 96-97
1. Agricultural sector											
1.1 Agriculture	3.4	-4.5	2.0	-11.0	5.0	-5.0	3.6	-12.8	3.1	-2.3	2.9
1.2 Allied Agricultural Activities	3.8	-5.1	2.0	-13.5	5.4	-5.6	4.1	-13.4	3.3	-2.6	2.8
	0.5	0.6	2.5	11.1	2.1	-0.3	-0.5	-7.2	0.7	1.2	3.2
2. Industrial sector											
2.1 Mining & Quarrying	6.1	4.4	8.2	2.1	5.0	4.1	6.5	-2.6	7.6	-1.9	10.1
2.2 Manufacturing	3.7	6.5	7.6	11.8	1.1	5.9	5.4	1.1	7.7	3.7	5.9
2.3 Electricity, Gas & Water	6.3	3.9	8.0	0.9	5.0	3.9	6.3	-3.2	7.4	-3.7	10.7
	8.5	15.2	12.9	10.4	9.4	4.7	9.6	1.2	8.9	9.6	8.3
3. Services											
3.1 Construction	4.2	1.7	5.8	3.2	4.3	2.8	5.7	1.0	6.5	4.6	7.5
	7.0	-12.2	8.0	6.7	2.6	2.3	7.1	-5.3	4.6	2.2	4.7
3.2 Trade	5.3	2.2	6.9	0.6	4.4	0.4	6.8	-3.2	6.1	0.9	10.9
3.3 Railways & Other Transport	4.5	7.5	6.5	5.9	4.7	6.7	6.4	3.9	6.5	6.1	4.5
3.4 Banking & Insurance	7.5	12.1	6.7	4.4	9.4	6.3	12.1	-3.5	13.0	17.4	9.8
3.5 Real Estate	2.2	2.2	2.4	2.6	2.7	3.0	3.1	3.2	3.6	3.2	3.7
3.6 Defence & Public admin.	4.0	7.8	9.1	3.6	7.2	3.7	4.8	7.1	7.5	2.1	3.4
3.7 Other services	2.7	3.2	4.1	4.2	3.5	3.0	2.4	7.5	5.5	5.9	5.6
4. GDP (at factor cost)											
	4.0	-1.2	4.3	-3.7	4.7	-0.3	5.0	-5.2	5.5	0.8	6.8

Source : Reserve Bank of India : occasional papers, June - sept - 1997

Table-II
Trend Growth Rates (Sectorwise - Agricultural, Industrial and Services Sector)

Sector/periods	1950-51 to 56-57	1950-51 to 65-66	1965-66 to 75-76	1976-77 to 91-92	1992-93 to 96-97
1. Agricultural sector	2.4	2.5	3.1	2.9	3.1
1.1 Agriculture	2.6	2.7	3.2	3.1	2.8
1.2 Allied Agricultural Activities	1.3	1.6	2.1	0.3	3.1
2. Industrial sector	5.6	6.8	4.2	6.5	10.1
2.1 Mining & Quarrying	5.4	5.7	2.7	7.5	5.9
2.2 Manufacturing	5.4	6.7	4.1	6.2	10.7
2.3 Electricity, Gas & Water	9.0	11.1	7.5	8.1	8.3
3. Services	4.9	4.7	3.8	5.7	7.7
3.1 Construction	4.6	6.7	1.6	4.2	4.7
3.2 Trade	5.1	5.7	3.7	5.5	10.7
3.3 Railways & Other Transport	5.2	6.1	4.5	5.8	5.6
3.4 Banking & Insurance	3.0	2.3	2.9	3.6	3.9
3.5 Real Estate	8.3	7.5	6.1	10.9	10.1
3.6 Defence & Public admin.	6.5	6.7	6.1	7.4	3.5
3.7 Other services	4.1	3.5	3.7	5.6	6.1
4. GDP (at factor cost)	4.1	3.8	3.6	4.9	6.8

Source : Reserve Bank of India : occasional papers, June - sept - 1997

Table-III
Flow of inputs to agriculture from various sectors in 1980's.

Sector/Term	Food Crops	Cash Crops	Plantation Crops	Others	Total
Agriculture	141026 [43.98]	24769 [32.25]	---	20918 [47.98]	186712 [38.99]
Food Crops	137201	---	---	1703	138964
Cash Crops	112	24768	---	667	25547
Plantation Crops	101	---	---	---	---
Other Crops	3713	---	---	18488	22201
Animal Husbandry	100157 [31.1]	20049 22.87]	2524 [30.91]	28051 [64.32]	150781 [31.49]
Sector/Term	Food Crops	Cash Crops	Plantation Crops	Others	Total
Manufacturing	41081 [12.75]	17547 [26.1]	2221 [27.21]	12798 [29.34]	73647 [15.40]
Cotton & Jute	472	---	---	9	481
Textiles	---	---	---	---	---
Petroleum	10483	1614	---	2126	14223
Fertilizer	25425	7090	509	7440	40467
Agricultural Machinery	1940	346	24	522	2832
Industrial Machinery	914	---	---	9	923
Construction	11012	1816	83	2669	15580
Transport	5786	2277	244	1619	9926
Electricity	9171	1816	4	1741	12235
Banking	4053	2817	2391	584	9845
Total Input	322149	76788	8165	43604	478757

Source : Indian Economic Journal, June-1994 (Sectoral linkage between Agriculture & Industry)

Table IV
Linkage between agriculture and the manufacturing sector
for the period 1970 - 1990

Particulars	Food Crops	Cash Crops	Plantation Crops	Others	Total
1. Backward linkage from agriculture					
(a) Total purchase of agriculture from manufacturing sector as a percentage of :					
i) Total output of manufacturing sector	1.60	0.68	0.09	0.49	2.87
ii) Total agricultural input	12.75	27.10	27.21	29.34	15.39
(b) Linkage coefficient	0.2176	0.1567	0.1034	0.0546	0.1681
2. Agricultural forward linkage					
(backward linkage from manufacturing sector)					
(a) Total intermediate sale of agriculture to manufacturing sector as a percentage of :					
i) Total Agricultural output	1.32	51.21	36.27	6.62	10.82
ii) Total input of manufacturing sector	0.69	9.38	0.38	2.07	13.61
(b) Linkage coefficient	0.1666	2.2602	0.5408	0.6078	0.4453

Source : Inter relationships between Agriculture and Industry Isher J. Ahluwalis

From the tables I and II showing trend growth rates we observe that the trend growth rate of food grain production which stood at 3.4% between 1950-51 and 1964-65 came down to 2.8% between 1966-67 and 1982-83. Growth rates of production of crops like cotton, oil seeds and sugarcane which happened to be mainly commercial crops have all came down since the mid seventies. Trend of growth rate which was 41% in the case of cotton during 1950-51 and 1964-65 came down to 3.0% between 1966-67 and 1982-83. Trend growth rates in oil seeds production declined from 3.4% during 1952-53 and 1964-

65 to 1.6% between 1966-67 and 1982-83. Thus not only in the case of food grains but in the case of crops required by industrial sector also there has been a slowing down of growth. Recent technological developments in Agriculture have failed to confer any special benefit to the production of these crops which are mainly required for Industrial production. Agriculture as a producer, consumer, provides a market for industrial production of agricultural inputs like fertilizers, tractors and tillers, and steel and cement for building dams, reservoir and canals, also for laying the canals, with the plastic industry now stepping in as a substitute and also for the new system of sprinkler irrigation. The trend growth rate shows that the average rate of Industrial growth in the first part of the plan era was about 50 percent more than in the second half.

It is possible that the slackening of Industrial growth in the second half was due to inadequacy of demand and hence improvement of agricultural income plays an important role. There has been a significant increase in agricultural production during the plan period specially after the green revolution. The average rate of agricultural growth can be enhanced through the introduction of genetic engineering crops in arid and dry areas can be grown profitably. We need to work on dry farming in this country, because even today one-third of the gross cropped area is drought prone. In the USA. and Japan, exclusive research has been done in this area. Many countries have achieved very satisfactory results. By adopting dry land farming Israel has been able to achieve extra ordinary agricultural growth and expansion rate. If we adopt this new technology, agriculture will undergo a second green revolution. This revolution may require organisational and structural changes like increase in the size of holdings.

The balance one needs between Industry and agriculture in development must necessarily involve both a dispersal of industrial activity and its decentralisation along with markets additional to local markets and dependence on local materials. The vast number of our agricultural population constitutes an potential market undistributed by quotas and tariffs⁶, but to realise this potential into an actual mass market, agricultural production will

have to increase, not only of small cultivators and medium and big farmers but also of the labourers, who are involved in cultivation and this means higher prices for agricultural produce and higher wages for agricultural workers⁷. It also means high investment both public and private not only to make land more productive but also for post harvest operations such as storage, inland transport and marketing. Increase of the purchasing power of the rural masses must also include the marginal cultivators who are underemployed and the rural non-agricultural workers who have lost their market to the products of modern urban industrialisation. All this means increased resource mobilisation on the one hand and the higher cost of living for the urban population and non-agricultural workers in the rural region. Unless Industrial employment is taken into the rural areas and there is decentralisation in the industrial development process there can be no substantial decline in the percentage of the labour force now employed in agriculture and other traditional rural occupations. If this is not done, there can be no reduction in the existing disparity between the per capita increase in the rural sector and that in the urban sector. Therefore development balance between agricultural sector and the manufacturing plus tertiary sector must involve a dispersal of industrial activity and its decentralisation along with dependence on local materials and hence the local markets.

If agricultural growth picks up to exceed the trends in the recent past, not only would there be enough food grains for the growing population but there would also be opportunities in agriculture for diversification of crops beyond food grains and hence for absorption of labour in a variety of agro based industries. This interpretation is suggested by the recent trend growth rates of agricultural production relative to manufacturing and service sectors. There are many ways by which Industry could help in increasing the agricultural income of the farmers⁷. Industries can adopt some of the areas or villages situated around their location and help in the development of infrastructure required for agricultural production and development in these areas. As in the case of fertilizers and pesticides, the Industry should not only be concerned with the distribution of these inputs but should also undertake training and education of the farmers for the balanced and judicious use of these inputs which would

ultimately help in increasing agricultural income by improving its own efficiency and adoption of better technology which would result in reduction in unit cost of production in Industry and lowering the prices of inputs needed by the farmers and ultimately raising their income. Industries can also help in developing and locating new markets for agricultural products processing of agricultural products and exports are the areas where industry has an important role to play in increasing agricultural income. Modern technology in agriculture is closely associated with the use of fertilizers, pumped water, plant protection and the use of tractors and threshers. This is closely related to the development of the industrial sector. At present in India Two-thirds of the labour force is employed in Agriculture. It generates 40 percent of national income and also contributes one-third of the industrial raw-materials. Compared to any country in the world, India has the largest ratio of arable land, which is 80 percent as against the world average of only 10 percent. In the USA, the total arable land is only 186 million hectares which is only one-third of what we have in India. India can be the largest producer and the biggest exporter of agricultural commodities. Therefore agriculture should be treated at par with the Industry. The mutual interdependence between agriculture and Industry can be elaborated. The share of agriculture in the national income has decreased from over 80 percent in the 70 s to 40 percent in the 90s and it is expected to decrease further. But this does not implies that agricultural production has declined in each five year plan. The additional output is about 30 percent higher than the preceding five year plan. It only reflects that the comparative percentage share of primary sector in national income is declining, whereas that of the secondary and tertiary sector is increasing which is a sign of Economic development. But considerable advancement of manufacturing and services sector or the non-farm sectors will not be easy unless they receive support from the farm sector in terms of food, raw materials, markets and capital flows. Agricultural development results in higher average labour productivity, which in turn steps up the demand for consumer goods produced in the industrial sector⁸.

Industrial development versus agricultural development is not an appropriate issue for the sake of development of either of these sectors. That is to say that industrial

development versus agriculture has become the false issue and the concern now is rather with the interrelationships between industry and agriculture and the contribution each can make to the other. The study of resource flows between agriculture and the manufacturing sector is mainly done through input-output analysis, because the input-output table shows the flows of goods and services from each sector of the economy to different branches of the economy over a specified period of time.

More important thing is the appropriate terms of trade between agriculture and industry along with the distribution of income with the basic consideration of equity. Agriculture according to Neo Keynesians is to be treated not only as the source of supply but also as a source of effective demand. Neo keynesians recognised of productivity in the wage-goods sector. If the generation of agricultural surplus is to be made meaningful, it should be over and above the consumption demand, which is determined by the income distribution in a country like India, being endowed with a large subsistence sector. Adelman (1984) links agricultural surplus generation with Industrialisation via consumption demand for Industrial goods but the generation of real surplus in agriculture is only a necessary condition and not a sufficient condition for the growth of Industrial sector. We can take the example of Korea in this context Korea achieved rapid industrialisation supported by foreign savings and preceded by rural development⁹. Here it was industry that was made instrumental to agricultural growth and not that the agricultural growth was made the base for industrial growth⁸. It is in this context that the medium and large sized industries, which shifted their manufacturing locations to small and medium towns, because it was considered more important in catering to the consumption demand of the rural areas.

From table III showing flow of inputs to Agriculture from various sectors it is noticed that manufacturing has contributed about 15 percent of the total input use in agriculture. Agriculture by itself has met about 39 percent of the total input needs and animal husbandry has supplemented over 31 percent and it implies that the primary sector alone meets over 70 percent of the input use in crop production, fertilisers, chemicals and pesticides and

agricultural machinery account for about 78 percent of the total input supplied by manufacturing. Among others, the contribution of construction, electricity and trade was relatively high and they continue to play a significant role in the development of agriculture. About 50 percent of the agricultural output flows to primary sector which includes crops and animal husbandry. It implies that the other half of the total output goes to manufacturing and other sectors like communication and banking which contributes about 29 percent of the total inputs supplied by others.

Among food crops out of total intermediate use, agriculture alone has absorbed about 66 percent and over 23 percent has gone to animal husbandry. Thus hardly 11 percent is left for other sectors and out of which about 4 percent has gone to hotels and restaurants. Agriculture has accounted for hardly 8 percent of the total intermediate use and the manufacturing sector absorbed the rest 92 percent. In the case of plantation crops entire marketed surplus has gone to manufacturing. Among the manufacturing sector cotton and jute textiles, food, sugar and tobacco are in order of importance in the purchase of agricultural output. This analysis has enabled us to identify the major manufacturing that depend on agriculture for its inputs and those that supply inputs to agriculture and the magnitude of the inter-industry transactions taking place.

The table IV showing linkage between agriculture and industry depicts that the dependence of agriculture on different crops. Food crops had the highest backward linkage coefficient and lowest for other crops. Agriculture contributed to industrial inputs relatively stronger than the backward linkage. Cash crops had the highest forward linkage coefficient. The inter-industry transactions show that manufacturing and other sectors are non-dependent in agriculture as compared to dependence of agriculture on agro-input manufacturing and other industrial sub-sectors. It implies that agriculture's forward linkage is relatively stronger than the backward linkage. Here it should be made clear that Agriculture's forward linkage implies the extent of dependence of agro-based industries and other industrial sub-sectors on agricultural output in the form of raw material (inputs) whereas backward linkage from

agriculture is the dependence of Agriculture on the agro input manufacturing industries in the form of agricultural inputs (Agricultural machinery and other technologically advanced implement). Thus we observe that though the inter industry transactions have increased but it was lowest in case of agriculture.

Preobazhensky¹⁰ (1965) was concerned with the supply potential of agriculture. He advocated its 'extraction' for the benefit of a higher level of industrialisation. The advocacy of such a subservient relation between agriculture and industry rests in the specific historical context of prolonged reliance on foreign countries for loans or higher industrial inputs. This also was necessary for the then USSR, which was surrounded by enemies to facilitate rapid industrialisation presumably because of the need for military self reliance. It was advocated when industry was no longer in the private sector but agriculture remained. So the compulsion of the development ethos of industry at the cost of agriculture forces the terms of trade to move against the agriculture (private sector) only to facilitate the process of surplus extraction. The major binding force of industrial growth is the wage-good constraints that can be removed by means of increasing agricultural surplus. The logical indispensability of the growth forces leading to the formation of an agriculture-industry nexus was discovered in the light of institutional changes in the agrarian structure that took place in early nineteenth century in England. Farming came to be organized on a commercial basis and farmers became capitalists in agriculture. The process of growth became dynamic when capital started moving freely from agriculture to industry and surplus agricultural labour began to move to industry with the surplus food from Agriculture. Institutional changes in Agriculture lead to better agriculture-Industry relationship. The agrarian transformation in Agriculture lead to an inequitable agrarian structure. In Order to remove institutional rigidities, agrarian transformation cannot be dispensed with. The agrarian transformation is to be sought in the full supply potential of agriculture. In order to realise the supply potential of agriculture fully or to maximise the production of wage goods, institutional rigidities should be removed. The growth of the labour intensive rural non-farm sector is seen as the solution to the problem of rural

unemployment⁹. Intersectoral linkage between the farm and non-farm sectors are expected to generate this growth but the inequitable structure of the agrarian economy acts as a constraint¹⁰. Land redistribution is a prerequisite for the expansion of the domestic market for labour intensive non-farm goods and hence for the development of this sector. Drawing surplus labour and food from agriculture for industrialisation suggests policy intervention to prevent the terms of trade from shifting in favour of agriculture. While paying less to agriculture for industrialisation and addressing surplus agricultural labour, independent of the response of the agrarian structure to such a move, amounts to reducing the expansion potential of the domestic market which allows agricultural income to be transformed into industrial demand into insignificance. Even if agriculture is paid less capital, the intensive modern sector may not prove capable of absorbing the surplus labour. Hence instead of assigning an accommodating role to agriculture to the requirements of the modern industrial sector, what is important is to reorganise the dynamic forces of agriculture that eventually link up to industry in the context of India. Efficiency is one of the dynamic forces of agriculture which may increase even without remaining the institutional rigidities of the agrarian structure. Technical revolution and prices are held responsible for transforming agriculture by way of generating short run supply responses.

Empirical evidence on the relationship between industrial growth and agricultural development shows that the industry's relative contribution to gross domestic product growth has exceeded that of agriculture¹¹. The services sector also has exceeded the agricultural sector, in terms of its share of GDP since mid seventies, with a more pronounced divergence during the post liberalisation year. If there is one sector that can take the lion's share of this divergence, it is trade. However, in India, the declining share of agriculture has not been accompanied with a corresponding fall in labour force engaged in agriculture. This has important implication for agricultural productivity. The fact that a sharp fall in the share of agriculture in national income in India is accompanied by a fairly stable proportion in the labour force in that sector shows that there has been a relative decline in productivity. Their

sectoral shares towards national income gets slightly altered if we consider the sector wise relative contribution to trend growth for all the periods. The relative contribution of services sector to the aggregate trend of GDP growth surpassed those of the other two sectors. It is since the mid seventies that industry's relative contribution to GDP growth has exceeded that of agriculture. Our study points out that the propensity to save in agriculture has been comparatively lower as compared to that of non-agricultural (Industrial and Services) sectors in contrast to the outcome in the related periods. More over there existed a comparatively high share of agriculture in GDP. Both these facts lead us to the conclusion that the sector with lower propensity to save had larger share of income, thereby depressing the overall saving rate. Thus the crucial issue is how to increase the agricultural sector's savings propensity in comparison to that of industrial sector. The green revolution led to more skewed distribution of Income within agriculture and there was a relative upward movement of saving propensity of agriculture as compared to the non-agricultural sector leading to narrowing of the differential of saving propensities between the two sectors

Inter-sectoral resource flows

The study of resource flows between agriculture and industrial sector is important in order to reach some important conclusion regarding the sectoral linkage between different sectors of the economy. The input-output analysis is a practical extension of the classical theory of general interdependence. Modern economists have developed this technique in quantitative terms. Industry and agriculture interact either in mutual stimulation pattern or in mutual sterilization pattern. Balanced growth helps the analyst to examine sectoral interrelations and judge their nature and this serves a useful purpose. In India some studies have been conducted for constructing input-output figures of resources flows between agriculture and manufacturing sectors. The importance of input-output technique has been tremendously measured during the planning era and particularly after the green revolution

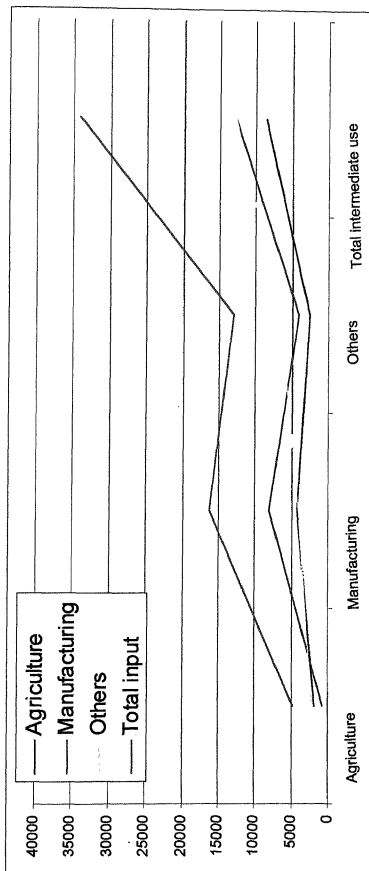
Table

The quantum of Inter-Industry transaction during period 1980-90

Sector	Agriculture	Manufacturing	Others	Total intermediate use
Agriculture	1867.12 (21.72)	4217.64 (49.06)	2511.78 (29.22)	8596.54 (100.00)
Manufacturing	736.19 (5.77)	8032.34 (62.95)	3991.28 (31.28)	12759.81 (100.00)
Others	2183.98 (17.12)	4045.17 (31.70)	6530.65 (51.17)	12759.80 (100.00)
Total input	4787.29 (14.03)	16295.15 (47.76)	13033.71 (38.21)	34116.15 (100.00)

Source : Resource flows between Agriculture and the Manufacturing sectors in India (1990) P. K. Sardans and R. K. Patel.

It is clear from the table that the share of agriculture in its own inputs is less than that of manufacturing and other sectors. Manufacturing and other sectors retain always half of their input. The manufacturing industries receive one fourth of their input from agriculture whereas agriculture receiver only 15.38 percent of its inputs from manufacturing. It proves that the dependence of manufacturing sector on agriculture is much more than that of agriculture on manufactureing. While comparing manufacturing with other sectors it is clear that their interdependence with respect to inputs supply is more or less the same. As far as the inputs supply relationship between agriculture and other sectors is concerned, agriculture is much more dependent on other sectors for its inputs (45.62%) whereas it supplies hardly one-fifth of its inputs to other sectors.



Recent extent of correlation between Agriculture and industry in India

When the economy is fairly advanced and agriculture has reached a high technology status, a situation of plentiful supplies for agriculture may arise with reference to a more or less stabilised demand for food and other agricultural raw materials with the result that agricultural prices would get depressed leading to a deterioration on the terms of trade. In the light of the trends in the inter-sectoral terms of trade since 1973-74. The question is whether Indian agriculture has reached such a state. Agriculture has undergone impressive degree of advancement with the share of inputs such as fertilisers pesticides and insecticides etc.. in the total inputs used in agriculture having almost doubled in real terms. The demand for industrial products by agriculture has been at a faster rate than the demand for agricultural products by the manufacturing and other industrial sub-sectors. while industrial production has not maintained an accelerated growth rate, the growth of agricultural products is less than needed for meeting economy's requirements of food grains and raw materials. An examination of the sectoral trends in production and inter sectoral relationships between agriculture and non-agriculture shows that both the sectors have recorded considerable expansion. Industrial production has been growing faster than agricultural production. Industrial production is well correlated with agricultural production. 7 percent growth in industrial production was associated with a 3.89 percent growth in agricultural production during 1951-60.. There has been no marked change in the sectoral distribution of workforce corresponding to the decline in the share of agriculture in the gross domestic product. An impressive advancement is observed in the exchange of production. The basis of linkages between agricultural growth and changes in rural industrial sector have become financial from the point of view of efficient allocation of lower class. presently level of agricultural yield per hectare and productivity per labour have increased resulting in surplus agricultural labour but they have not been so far efficiently employed in the rural industrial sector to a considerable extent.

The Indian economy has began to develop inter-sectoral interaction and has maintained the process of overall growth of the economy. This seems to play an important role at every

stage of the functioning of the economy from production through exchange to consumption. Besides, change in agricultural sector production affects transfer of income between agricultural and non-agricultural sectors of the economy. The agriculturists are worried not about the 'parity prices with industries but with their own commodity prices with other competing crops.

Notes and Reference

1. Industrial Revolution in Europe was preceded by Agricultural revolution. that is to say that Agricultural development paved the way for industrial development. Thus though both the sectors are complementary to each other but it weighs more in favour of agriculture.

2. Prof. Kuznets, 'Interrelation between Agricultural Sector, Manufacturing Sector and the Territory Sector', EPW Sept. 1975.

3. Apart from other inputs, modern thechnology has played maximum role in augmenting the growth rate of agriculture. This has also been true in case of other sectors, manufacturing and tertiary. Agricultural development pushes the industrial growth upwards and maximises the overall GDP. But agriculture alone cannot do any miracle. It has to be interlinked with industrial development.

4. Kahlen A.S. and Tyagi D.S. (1983), 'Agricultural Price Policy in India', Allied Publishers.

5. Thamasrajakshi R. (1977), 'Role of Price Incentives in Stimulating Industrial and Agricultural Production in Developing Economy', Food Enough or Starvation for Millions
FAO.

6. Rangarajan C. (1982), 'Agricultural Growth and Industrial Performance in India' Research Report 33, Ocotober, International Food Policy Research Institute.

7. Chakravarty, S. (1974), 'Reflections on the Growth Process in Indian Economy' Hyderabad Administrative Staff College of India.

8. Raj K.N. (1976), 'Growth and Stagnation Indian Industrial Development', Economic and Political Weekly, 26 November.

9. Adelman (1984), Industrialisation and consumption demand of Rural sector generally it was assumed that Agricultural development was instrumental for industrial development. But Korea has experience that it was industrial development which proved instrumental for overall GDP growth and not the agricultural growth.

10. Preobrazhensky (1965), 'Subservient relation between Agricultural sector and industry', A higher industrial import for USSR.

11. Agricultural output marketed to industrial sector means the payment received by the farm sector which determines the purchasing power of the farm community. The more they receive real income they will be ready to spend upon industrial goods. Thus higher prices of agricultural goods would not only mean an incentive for higher agricultural production but also it would provide an expanded market for industrial consumer goods resulting in the development of industrial sector.

4.1 Terms of Trade : A Concept

The terms of trade between agricultural and non-agricultural sector (Industrial sector) have been the subject of research and analysis of many Economists. Most of these studies have defined the terms of trade as a ratio of wholesale farm indices of agricultural products to that of non-agricultural or industrial products. These aggregate indices in turn are based on the wholesale price indices of the components of agricultural and non-agricultural commodities combined using the weights in the official wholesale price index. Thamarajakashi¹ (1977) on the other hand had derived a set of weights independently using detailed data on inter sectoral trade flows between agriculture and Industry. She has updated three estimates in a paper contributed to sixty eighth conference. Alternatively, terms of trade can be defined as the ratio of implicit deflators of agriculture and non-agriculture. A third methodology in the definition of terms of trade between agriculture and non-agriculture is used by Kalhan and Tyagi (1983) in a study. They use farm gate prices of agricultural products and then combine these prices using a set of weights obtained from the 26th round of the NSSO. Consumer expenditure for cultivator house holds : Rural (July 71 - June 72) has also been analysed.

It is worth noting that all the series of terms of trade as described above are only approximation to the series of an index of the relative price of wage goods (food grains) in terms of product prices (manufactured goods). However these series by and large shows the same trend over time. The overall picture is that of a clear rising trend upto 1967-68, a clear declining trend after 1973-74. The implicit price deflators show this as revised and updated Thamarajakashi series follows this pattern closely and much the same is true of the Kalhan and Tyagi series².

Thamarajakashi³ has provided an analysis of terms of trade between agricultural and non - agricultural sector using the data between 1960-61 to 1982-83. She has calculated ratio of implicit deflators, that is agricultural versus Industrial sector. A Study of the inter relation between agriculture and Industry in the centre of economic development is of vital importance not only as the relative forces of inter sector demand and supplies of development but are also a manifestation of the stage of growth. The inter sector movement of product is essentially a function of the pace of economic development and are links between the two sectors in the products and factor market⁴. The terms of trade between the two sectors is decided by different kind of inter-sectoral linkages in the size of the market which the agricultural sector provides for Industrial consumer goods, proper supply of agricultural output marketed to the Industrial sector, the purchasing power of the agricultural sector, the nature of wage distribution and the pattern of consumer demand in rural sector and the extent of diversification

The concept of terms of trade has been intensively used, at the international and national level. It was used for understanding behaviour of sectoral relationship (between Agriculture and Industry) in an economy for the first time in Soviet Russia. This concept was first used in the context of inter national trade by Jacob Viner. This was further developed and used in the context of international trade in Europe by Kevilleberges Lenin had argued that technological improvement in agriculture could prove instrumental in Industrial progress because due to improved technology we could extract higher surplus. Regarding terms of trade between the two sectors in India the main of conclusion of the research done so far has been that the price policy and there by terms of trade in India have been unfavourable or biased against agriculture Dandekar⁵ (1986) stated that the terms of trade have never been favourable to agriculture because of lack of flow of resources to this sector. Thus higher investment has been advocated for agricultural sector on the basis of capital output ratio. Lipten observed that policy makers deliberately tilted the terms of trade against agriculture in India even though the peasants responded to price incentives.

Thus the concept of terms of trade which originated in the context of international trade has been elaborated and is being used for the study of intersectoral relationship and hence to improve the disparity and remove the disproportionality crisis so as to augment the national growth and development.

4.2 Review of relevant studies

There has been exclusive literature exploring the nature of terms of trade between agriculture and industry in the Indian economy. Some researchers have also tried to quantify certain aspects of inter relationship in trading movements in terms of trade between the two sectors. The significance of these interrelationship arises from the fact that Agriculture is still by far the largest contributor to net domestic product. Besides, the security of foreign exchange means that bottle necks, arising from agriculture cannot be easily met by imports.

A Mitra⁶ (1978) in his paper. "Terms of trade and class relations" points out that as agricultural means increases this results in an increase in the demand for industrial consumer goods and some producer goods. Consumer goods account for over a third of the value added in the industry . Thus the influence of agricultural demand side mechanism as the growth of industrial consumer goods can be significant. But the growth of agricultural income over time has been quite meagre. This implies slow expansion of an important component of demand for industrial consumer goods leading to an adverse terms of trade towards industrial sector.

As pointed out by Meller and Uma Lele⁷ (1973) during the initial stages of development of an economy, a very large proportion of additional investments of income generated through investments might be spent on foodgrains and other agricultural consumption product. This is due to the low marginal rate of substitutions of other

commodities for foodgrains. The phenomenon of rapidly rising demand also holds good for non foodcrops. Mellor concludes that in a developing economy the income elasticity of demand for all agricultural products would be fairly high.

Lewis (1954)⁸ in his “wage goods constraint and terms of trade” emphasizing the importance of foodgrains linkage in the growth of industrial sector observes that the problem arising from changing terms of trade between agriculture and industry was typically finessed in the conventional treatment of surplus labour in two sector single good models by assuming that the two sectors produced the same good. The importance of the foodgrains linkage or more broadly, “The wage goods constraint” as the of known the possibility of a wage goods constraints or the absorption of labour into the industrial sector in spite of the existence of surplus labour in a developing economy was first recognized by Lewis (1954).

The Patnaik⁹ hypothesis is interesting in the sense that it relates the stagnation idea to deceleration in agriculture which caused demand constraints for the manufactured product and to a cutback in public investment following the crisis which in turn led to a drastic fall in private investments considering that its is primarily guided by profit consideration. Though Chakravarty and Patnak both emphasize the efficiency in the inelastic character of agricultural production, the former is pessimistic in the sense that he does not think in terms of curbing this character through public investment while the latter is not.

The cutback investment agreement is also extended by Srinivasan and Narayane in an elementary way. Sandesara's thesis attributes the deceleration in growth performance to two reasons : (i) the slow growth rate in the installed capacity, and (2) the administrating efficiency in their utilisation, while admitting the associate of other factions in the process, the arguments no doubt carry weight but doubt explain the complete concept. The tendency has been to emphasize either the supply or the demand, constraints or both to explain the structural retrogression since the mid-sixties. It is evident that the root of Indian economic stagnation strongly lies in the basic structural linkages but are has to find a visible alternative

so as to avoid an awakened situation in failure and to check the possibility of a recurring crisis.

G. S. Monga and Madhu S. Pangrahi in their "Disproportionality crisis and role of agriculture have pointed out that the growth process in a labour-surplus under-developed economy is surrounded by a crisis of sectoral unbalances and disproportionality which expresses itself in terms of an altered industrial structure. Slowly progressing agriculture accompanying a process of top-heavy industrialization being the gradual slow down of the overall growth rate. They have also provided the solution. According to Madhu. S. Pangrahi, the disproportionate growth in agriculture and industry causing the crisis can be removed permanently, if there is switch over to the wage-goods model which directly recognises the role of economic surplus in economic development. It also establishes a strong structural linkage. The objective of an appropriate structural change has failed primarily because of lack of comprehension of the role of the primary sector which has almost become the neglected sector.

Vakil and Brahmananda in their alternative planning strategy have led to the solution of the traditional problem of disproportionality crisis - the disproportionality between agriculture and industry. They ensured a strong structural linkage as per the savings constraints, with the sectoral linkages that could be established by that model, the growth process could have been augmented without any major cyclical pressure.

- According to Mrs. Joan Robinson, the agro-based plan through the strong linkages established with the traditional industries could, over fulfil the targeted growth rate in the economy. The wage goods and the raw material needs of the Indian Industry could be domestically fulfilled, the economy being highly independent of the international sector. Regarding top heavy industrialization dominating the Indian economic scene Maurice Dobb introduced the idea that the rate of savings and investment, both public and private have to be expanded at a much faster rate in the capital goods sector. This would ensure a further

generation of saving in order to make the industrial project self-financing. But for this the supply in the primary sector of the economy should be elastic and must keep pace with the fast upsurge in the industrial expansion if the growth process has to be continuous and equilibrium oriented. Thus in order to remove the sectorial imbalances, the rapid expansion in the top heavy industry must be accompanied by a simultaneous and continuous growth in agriculture.

Lewis¹⁰ models based on Marxian thesis suggest that for some time to accelerate capital formation in Industry, Agriculture has to bear the burden of providing surplus resources.

Backchi in the Indian context and Ishikawa in the Asian perspective have questioned the validity of development theories. They argued that the modern Agriculture based on the intensive use of chemicals and other capital intensive inputs needs good of investments in itself. Hence its is undesirable to drain away its resources and on the other hand it needs resource useless to keep pace with the technological change in other sectors of the economy.

- Empirical studies conducted by Sau & Mundle reveal that both in the colonial and over a sustained period in the post-colonial India, resources were drained away from Agriculture and the same was not properly utilized for productive investment with in India. However Mody argued in the reverse.

Value added in Agriculture recorded a relatively high growth rate of a little over 3 percent per year during the post independence period upto 1964-65. An importance feature of this growth performance as pointed out by Bhalla (1985), was that of a growth rate of 3.3 percent during the fifties all along. Seventy percent of the total growth of output was accounted for by area increases and only thirty percent through increases in yields.

Schultz¹¹ (1964) argued that a number of developing nations including India were following price polioicies based against agriculture and that such policies were adversely

affecting the incentive to invest in agricultural development. Mason (1964) in a study of development in India and Pakistan, concluded that agricultural development in both the countries was characterised during the early period by declining incentives to farm outputs as the internal terms of trade moved against agricultural products.

Ishikawa¹² (1967) drawing from the Chinese experience, argued that when economic activities are experiencing a change from export surplus to import surplus is import surplus is maintainable in the farm sector. He further elaborated that since in Asian countries like India and China unlike Japan and Taiwan, development levels in terms of per capita GNP and degree of development of market economy was low, inter-sectoral resource flow gained importance.

S. Munde¹³ argued that in the period of 1951-71 intersectoral resource flow had been favourable to agriculture in and around the terminal years. He further adds that slow growth of agriculture up to the mid-seventies was attributable to the drain of resources from Agriculture. Charanjit Sen (1985) and Amit Bhaduri's asserted that structural change is responsible for the degree of commercialisation of agriculture. According to Deepak Nagar (1978), past experience suggests that a secular movement in the intersectoral terms of trade in favour of Agriculture, operating through a squeeze of profits might have held back industrial expansion. Ahluwalia (1985) in her study on growth and stagnation of Indian Industries, came to the conclusion which suggested that favourable terms of trade for agriculture or of wage-goods were responsible for stagnation of Indian Industries since the mid-seventies.

The terms of trade debate as argued by Seth, Sinha and Krishna. States that a high income elasticity of demand for agricultural products coupled with a rate of expansion of population necessitates for any given increase of per capita income a substantial step-up in agricultural supplies. But due to subsistence and non-commercialized nature of agriculture supply-demand gaps arise which is reflected in an upward trend in the prices of all agricultural products. Rising agricultural prices push the cost of industrial production. Krishna and

Sinha conclude that this high income elasticity of demand for foodgrains for other non-agricultural products not only pushes up the agricultural prices but also industrial prices. This finally benefits a small group of big farmers and hurts the large section of small and marginal farmers and changes the nature of terms of trade.

L. S. Venkataraman (1979) is of the view that in general, changes in the terms of trade should reflect underlying structural changes in the relationship between agricultural and the remaining sectors of the economy. When the economy is fairly advanced and agriculture has reached a high technology states, a situation of plentiful supplies of agriculture may arise with reference deterioration in to a more or less, established demand for food and other agricultural raw materials with the result that agricultural prices would get depressed leading to a detraction on the terms of trade.

Chakravarty¹⁴ (1974) elaborated on this theme in the Indian context. He studied the problem arising from fluctuating terms of trade between the two sectors from the point of view of a developing economy like that of India. Lewis puts it in this way. If the capitalist sector produces no food, its expansion increases the demand for food which raises the price of food in terms of capitalist products and so reduces profit. Hence if we postulate that the capitalist sector is not producing food, we must either postulate that the subsistence sector is increasing its output or else conclude that the expansion of the capitalist sector will be brought to an end through adverse terms of trade eating into no profits. It is therefore possible to have a situation of surplus labour through supply of Labour being perfectly elastic at a constant real wage in terms of food grains coexisting with a situation of wage goods constraint.

I. J. Ahluwalia (1985) in his "Industrial growth in India-stagnation since the mid-sixties" reaches the conclusion that an increase in the terms of trade between food grains and industrial products lead to an increase in the product wage facing the industrial producer if it does not imply that all increases in the product wages reflect a wage goods constraints.

Such increases could reflect a process of general growth involving improved Labour productivity or increasing bargaining strength of Industrial labour overtime. A wage goods constraint on industrial growth can arise in the manner that an increase in the terms of trade in favour of food grains in the absence of other changes, would lead to an increase in the product wage for the industry. To the extent that this is not associated with an increase in productivity, it squeezes profits and stifles industrial growth.

A Dhar (1968) in his "Domestic terms of trade" views that observed movements in the terms of trade between agriculture and industry or broadly speaking, the observed movements in terms of trade between food grains and manufacturing along with the trends in the availability of food grains does not suggest the presence of wage goods constraints on the growth of industrial labour. Fears about a decline in the trend rate of growth of food grains output that were expressed by some writers have proved to be unfounded.

Apart from the dependence of industry on agriculture for the supply of food grains, there is a part of the industrial sector which relies for its material supply on agriculture. This sector consisting of agro based industries constitutes about one third of the value added in the industrial sector. Due to increasing industries importance of non-traditional and heavy industries this share of Industries of agro based is expected to decline. It may lead to a reduced dependence of industry on agriculture for inputs. On the other hand dependence of agriculture on industry for inputs has increased due to modernisation of Indian agriculture.

In order to analyse the relative terms of trade C. Rangarajan compiled the relative magnitude of the interdependence of the two sectors for inputs. He maintains that an increase of Rs. 1.00 in the final demand for agricultural goods results in an increase in the output of manufactured goods of Rs. 0.09, whereas an increase of Rs. 1.00 in the final demand for manufactured goods results in an increase in the output of agricultural goods of Rs. 0.26. This shows that the dependence of industry on agriculture is greater than that of agriculture on industry.

4.3 Scope and limitation of terms of trade

Before turning to certain aspects of the evolution of interdependence between agriculture and industry it is useful to reanalyse the relative magnitude of the interdependence at a point of time as compiled by Rangarajan (1982). In his words, “taking into account direct and indirect requirements, one can see that an increase of Rs. 1.00 in the final demand for agricultural goods results in an increase in the output of manufacture goods of Rs. 0.09. whereas an increase of Rs. 1.00 in the final demand for manufactured goods results in an increase in the output of agricultural goods of Rs. 0.26 . It is worth mentioning that Rangarajan focuses on the interrelationship between agriculture and manufacturing, whereas our analysis explores, the linkage between agriculture and industry.

In view of the slow growth of the principal agro-based industries it is reasonable to expect reduced dependence of industry on agriculture in this respect. In analysing the dependence of agro-based industries on agriculture for materials two considerations need to be borne in mind. First to the extent that the materials can be imported, it is the overall scarcity of foreign exchange that lends greater significance to the agro based industries dependence on domestic agricultural materials. Second, it is not possible to analyse the growth performance of industries such as textiles and sugar. These industries much less assess the constraint imposed from agricultural materials on their growth with out reference to the compiled frame work, with in which each of these industries operates. The framework itself varies from industry to industry and reflects in each case their piecemeal evolution over a long period because of the traditional nature of these industries.

The shift in the intersectoral terms of trade in favour of agriculture since the mid sixties obviously cause the profit margin to decline sharply and with this declines the savings

and investments of the non-farm sector. The crisis in agriculture was mainly due to this existing declearing profit in non-agricultural sector. On a different plane is the Mitra thesis in which the class forces are considered to be the main factor behind the traffic drama of the shift in intersectoral terms of trade that caused industrial stagnation. The truth behind the terms of trade argument causing a crisis in economic development is much more than ordinarily one can grasp. Agricultural production as compared to industrial production is less susceptible to floatation in the prices of agricultural produce that changes whole price indexes.

4.4 Methodology and Availability of Data

There is too much controversies regarding the methodology and use of required data for the computation and cousequently a theoretical and emprical analysis of terms of trade in Indian economy. There is an evident lack of consensus among Indian researcher and academicians on the required information and the method adopted for working out the terms of trade indices. Some economists have used the ratio of the whole-sale price indices for agricultural and industrial products to define the terms of trade. These aggregate indices are based on the whole sale price indices of the components combined using the weights in the official whole-sale price index series.

For the Indian terms of trade analysis we have depended upon various official statistics like national sample survey, central statistical organisation, wholesale price indices for our own research and analysis. This is so particularly for a study as comprehensive as intersectoral terms of trade in a developing economy is eg India in our case. Studies using whole-sale price indices suffer from the limitations, like groups, of as manufacturing good, for which index-numbers of wholesale prices are available, include many such commodities which

were not transacted between the two sectors. Thus direct estimation of terms of trade with the help of whole sale price indices is not without shortcoming and limitations. Limitations of the whole-sale price indices for agriculture have been spelt out by Kahlan & Tyagi who used farm gate prices of agricultural products in their analysis of terms of trade. Thamarajakshi prepared different sub-groups of agricultural and non-agricultural commodities after combining various commodities and has given weight to various items for deriving price indices. Kahlan & Tyagi differs from Thamarajakshi on coverage of commodities for various uses and weights assigned to them. They also differ regarding the nature of terms of trade. Thamarajakshi and Mittal are in favour of 'income terms of trade to measure the capacity of the farm sector to purchase industrial goods, but Kahlan & Tyagi favour, 'net barter terms' of trade.

We have depended upon net barter terms of trade for comparing prices of trade commodities because it seems to be more relevant. For analysing the capacity of agriculture to import goods from industrial sector or vice versa, income terms of trade seems to be most helpful. It is evident that the commodity terms of trade and the income terms of trade are two different methodologies to give two different conclusions. In the case of two sector (Agricultural & non-agricultural) model, the income terms of trade of both the sectors could register significant increases leading to a conclusion that the purchasing power of both the sectors had increased. But the concept of net barter terms of trade implies deterioration in the terms of trade of one sector as it has shown some improvement in the other. Thus we have taken the help of these two different tools as per their maximum suitability and relevancy. The concept of income terms of trade based only on the volume of exports of one sector does not give appropriate conclusion. The concept of net barter terms of trade is found more relevant for analysis. To determine net barter terms of trade between agricultural and industrial sector, we make use of the index number of prices, received and paid by the farmers.

4.5 An Analysis of Terms of Trade

Some Economists have tried to quantify certain aspect of interrelationships between agriculture and industry in India either in a circumscribed quantitative framework, e.g., in tracing movements in the terms of trade between the two sectors or in the context in the terms of trade between the two sectors or in the context of an overall macro-economic model. The significance of these interrelationships arises from the fact that agriculture still plays a dominant role in the Indian Economy. The share of agriculture in Net Domestic product at 70-71 prices declined from over 58 percent at the beginning of the second five year plan i.e. in 1956-57 to 37 percent in 1989-90 but even in 1989-90 agriculture was by far the largest contributor to net domestic product. Besides the scarcity of foreign exchange means that the bottle-necks arising from agriculture cannot easily be met by imports. The linkages between agriculture and industry can be classified into four categories is (1) supply of food grains from agriculture to industry to facilitate absorption of labour in the industrial sector (ii) inter dependence of agriculture and industry for productive inputs is supply of agricultural materials such as Cotton, Jute, Sugarcane etc. to agro-based industries and supply of fertilisers, electricity and agricultural machinery by industry to agriculture, (iii) generation of demand for industrial consumer goods e.g., Sugar, Textiles, edible oils etc. as agricultural incomes increase, and (iv) possible generation of surplus of savings in agriculture which can be mobilised for investment in industry and other sectors of the economy.

The terms of trade between agriculture and non-agriculture have been the matter of in-depth analysis of many researchers. Most of these studies have defined the terms of trade as a ratio of wholesale price indices of agricultural products to that or non-agricultural of industrial products. These aggregate indices in turn are based on the wholesale price indices of the components (of agriculture or manufacturing as the case may be). Combined using the weights in the official whole sale price indexes. Thamarajakshi has derived a set of

weight independently using detailed data on intersectoral trade flows between agriculture and industry. Alternatively terms of trade can be defined as the ratio of implicit deflators of agriculture and non-agriculture.

Table 1

Terms of trade between Agriculture and non Agriculture

(1960-61 to 1992-93)

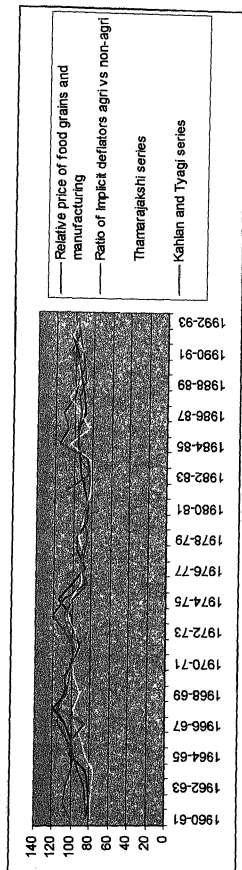
1971-71=100

	Relative price of food grains and manufacturing	Ratio of Implicit deflators agri vs non-agri	Thamarajakshi series	Kahlan and Tyagi series
1960-61	82.9	83.6	78.5	101.4
1961-62	80.4	84.2	79.1	107.5
1962-63	81.2	85.6	77.8	105.4
1963-64	83.9	92.1	76.5	99.8
1964-65	100.6	97.2	85.4	97.5
1965-66	100.3	103.7	89.9	99.6
1966-67	106.0	114.3	96.7	85.4
1967-68	119.1	114.6	98.2	115.6
1968-69	104.7	107.9	91.4	105.1
1969-70	108.2	106.4	98.7	101.8
1970-71	100.0	100.0	100.0	100.0
1971-72	91.4	98.4	94.6	97.5
1972-73	98.0	108.8	97.2	103.6
1973-74	101.7	120.6	105.3	108.3
1974-75	116.0	108.8	102.3	99.6

1975-76	101.7	86.6	92.4	84.6
1976-77	87.2	90.4	90.9	89.3
1977-78	95.1	87.9	90.5	90.8
1978-79	96.2	84.6	95.1	85.4
1979-80	85.9	88.1	91	88.6
1980-81	84.4	86.2	87.3	87.5
1981-82	87.7	82.5	81.6	107.3
1982-83	91.5	82.4	81.8	82.4
1983-84	93.4	85.9	83.4	91.6
1984-85	95.8	115.8	105.4	95.1
1985-86	94.2	105.7	85.5	95.4
1986-87	87.6	111.1	93.4	92.4
1987-88	89.5	99.8	105.7	94.7
1988-89	91.4	95.4	95.1	87.6
1989-90	94.7	89.1	97.5	89.4
1990-91	97.0	92.4	91.4	103.4
1991-92	103.4	95.1	103.4	95.5
1992-93	95.3	97.0	95.8	95.8

Source: Isher J Ahluwalia, Inter relation ships between Agriculture and Industry, National accounts

As is evident from Table 1 - That there has been a rising trend upto 1967-68, a clear declining trend after 1973-74, and a decline and recovery in between period. It is worth mentioning that both the series of terms of trade (Thamarajakshe & Kahlan and tyayi series) are only approximation to the series based upon of the relative price of wage goods in terms of product prices. However these series by and large show the same trend over time. It appears that over the two decades from 1959-60 to 1979-80, the output of food grains



increased at compound annual rate of 2.5 percent and the first 5 years of eighties have been of a somewhat higher order. The growth of marketed surplus relative to the output of agriculture also picked up marginally after the midsixties. In spite of a major decline in the import of food grains after the mid sixties, the per capita net availability of food grains per day did not show a declining in trend but fluctuated around a level of 450 gms per day over the entire period (1961-93).

A scissor like trend during the first plan and a steeper rising trend or a rather after 1960 is quite notable. This indicates a more favourable terms of trade for the agricultural sector. In an industrial growth strategy a favourable terms of trade for agriculture does not sustain itself, as it means that resources would flow to a less profitable and more inelastic supply sector, which is not subject to increasing returns to scale³². The common argument is also that the income elasticity of demand for food is less than unity while non-agricultural goods are income elastic. It is to be noted that favourable or unfavourable terms of trade is not an end in itself. The more important question is whether it leads to favourable output responses in agriculture and industry on lines of Recardo. Till there is fertile land left a relatively lower prices of agriculture would boost industrial production, by way of cheap raw materials, cheap food and cheap labour. This view would support cheaper agricultural goods and so the present trend in India of a constantly increasing relative prices of agriculture, may be growth-retarding. A justification for relative prices moving around 100 as witnessed during the first plan is made on the ground that falling agriculture, make the terms of trade favourable to industry due to falling prices of raw materials, while food prices are independent relative to industry. Thus the loss here is a loss to raw-material farmer and not to the food farmer. Further the food prices have shown lesser volatility than raw material prices during falling price. The effect of food prices on industrial wages is therefore indirect, but mildly positive. This implies that in periods of falling prices industry would gain greatly due to relative volatility of raw material prices. If industrial prices in this phase, rise relatively, agriculture may continue to have increasing demand in the raw material sector while the food sector, being mainly non-commercial, but having a positive income elasticity, does not

have to lose much. The relative net gain in the falling price periods therefore will be positive.

Another point to note here is that the relative price changes during the 'scissor' period (first plan) does not show any evident cycle but almost a stable situation. Thus a fall in agricultural prices leads to stable situation than a rise. During rising prices, it is again the 'raw material prices which becomes more volatile and has a 'dragging' effect on industrial prices and becomes a cost-push factor. The food prices at higher levels also effect the wage-demand flow.

In a developing economy, the process of continuing readjustment of agriculture and other sectors become necessary. The industrial sector which is predominantly the consumer of agricultural output have to readjust and change its production pattern in order to include in its product-wise resources such as fertilisers, pesticides improved machinery and implements, diesel engines, pump etc. The rapid progress in the agricultural sector of our economy during the recent past has resulted in the expansion of the industries which manufacture agricultural input and industries involved in the processing and preservation of agricultural, horticultural, livestock, farm products etc. The economy has thus begin to develop intersectorally with interaction and reinforced the process of overall growth of the economy. On the whole, in the matter of employment, production, income distribution, consumption, adoption of new technologies etc., growth of agriculture has assumed critical importance for the well-being of a majority of the population in our country. The development of agriculture, besides other things also depends on the relative prices of inputs and output. In the market economies where the price system is considered as a sleeping mechanism for achieving a desirable allocation of resources, price policy has a crucial role to play which has multi-dimensional effect on employment, income distribution, consumption, production adoption of technology etc. In a country like India where majority of population spends almost two third of its expenditure on food alone, movement in food grains prices, immensely effect both income and consumption levels of the vast population. These prise play an important role at every stage of the functioning of the economy from production through

exchange to consumption.

Table 2

Flow of inputs to agriculture from various sectors

Sector/Item	Food crops	Cash crops	Plantation crops	Others	Total
Agriculture	141026	24768	-	20918	186712
Food crops	137201	-	-	1703	138964
Cash crops	112	24768	-	667	25557
plantation crops	-	-	-	-	-
Animal Husbandry	100157	20049	2524	28051	150781
Manufacturing	41081	17547	2221	12798	73647
Cotton & Jute	472	-	-	9	481
petroleum	10483	1614	-	2126	14223
Fertilizers	25425	7090	509	7440	40467
Agr. machinery	1940	346	24	522	2832
Ind. machinery	914	-	-	9	923
Others	39885	14424	3420	9888	67617
Construction	11012	1816	83	2669	15580
Electricity	9171	1816	4	1741	12235
Transport	5786	2277	244	1619	9926
Communication	169	25	-	34	228
Trade	9362	6164	698	3183	19407
Banking	4053	2817	2391	584	9845

Source:-Ahluwalia (1965) Thamarajakashi (1977) Kalhan & Tyagi

Industrial development versus agriculture has become the false issue, and the concern

now is rather with the inter-relationships between industry and agriculture and the contribution each can make to the other. The shift of resource flows between agriculture and manufacturing sector is also important for balanced development of these sectors and helps in strengthening the theory of balanced growth. The theory of balanced growth as contained in input-output analysis is important for analysing a wide range of empirical problems connected with planning. This can also be regarded as a balance in demand and supply among different sectors. Ultimately, industry and agriculture interact, either in mutual stimulation pattern or in mutual sterilization³⁴. In India some studies have been conducted for constructing input-output tables of resource flows between agriculture and manufacturing sectors.

It will be useful to quantify the flow of inputs to agriculture from various sectors. Manufacturing has contributed about 15 percent of the total input use in agriculture. Agriculture by itself has met about 39 percent of the total input needs and animal husbandry has supplemented over 31 percent and it implies that the primary sector alone meets over 70 percent of the inputs use in crop production; Machinery account for about 78 percent of the total input supplied by manufacturing. The contribution of construction (23.04), electricity (19.09) and trade (28.70) was relatively high and they continue to play a significant role in the development of agriculture. Communication and banking contributed about 29 percent of the total inputs supplied by others. About fifty percent of the agricultural output flows to primary sector which includes crops and animal husbandry. It implies that the other half of the total output goes to manufacturing and other sectors. Among food crops out of total intermediate use, agriculture alone has absorbed husbandry. Thus hardly 11 percent is left for other sectors and out of which about 4 percent has gone to hotels and restaurants. However in case of cash crops, situation is just reverse. Agriculture has accounted for hardly 8 percent of the total intermediate use and the manufacturing sector absorbed the rest.

On the other hand in the case of plantation crops entire marked surplus has gone to manufacturing. As regard the other crops, the bulk (69.61 percent) has gone to the animal husbandry. Among the manufacturing sector cotton and jute textile, food, and sugar are in

order of importance in the purchase of agriculture output. This analysis has enables us to identify the major manufacturings that depend on agriculture for its inputs and those that supply inputs to agriculture and the magnitude of the inter-industry transaction taking place. In determining the relative strength of the production linkage between agriculture and manufacturing two different measures used is the forward linkage and the backward linkage which will be explained in the next chapter of the thesis namely 'sectoral linkages in the input-output.

Whatever the nature of the explanation provided, it should be clear that the structural retrogression occurring after the mid sixties was the result of sectoral imbalances in terms of demand and supply. However it is true that the exact forces causing it may found to vary from one analysis to another and that has become a debated issue among economists. Agricultural production as compared to industrial production is less susceptible to fluctuations in the prices of agricultural produce. The change in agricultural price index during the last two decades (1975 to 1995) caused a variation in total agricultural production of 5 to 6 percent as compared to corresponding high figure of over 40 percent in industrial production. The inter-industry transaction shows that the manufacturing and other sectors are more dependent on agriculture as compared to dependence of agriculture on the other. Primary sector needs over seventy percent of input use in crops production. Agriculture absorbs 66 percent of its food crops. There has been an increasing trend towards inter-industry transaction overtime.

Table 3

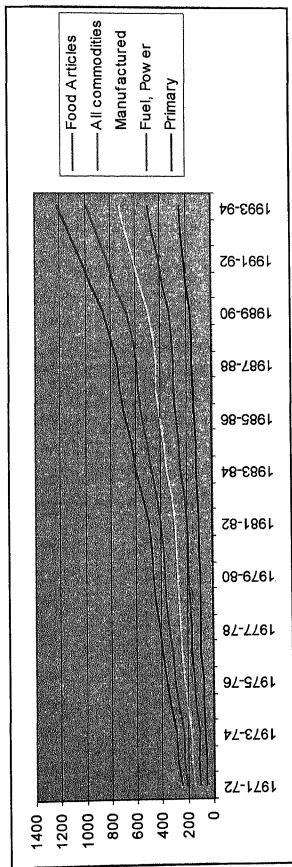
Wholesale price index of (sector wise) commodities

Base : 1981-82 = 100

	Primary	Fuel, Power	Manufactured	All commodities	Food Articles
1971-72	48.2	51.7	57.4	50.5	45.8
1972-73	55.3	55.7	60.2	55.5	50.4

1973-74	60.4	48.2	65.6	57.3	60.7
1974-75	70.4	60.4	71.8	62.9	62.4
1975-76	77.7	71.3	80.5	66.6	68.7
1976-77	88.5	73.3	82.3	70.7	75.5
1977-78	92.5	75.9	91.4	77.7	80.3
1978-79	98.4	81.9	93.5	88.8	84.3
1979-80	98.5	84.5	94.8	92.9	91.8
1980-81	99.5	90.7	97.8	97.5	96.5
1981-82	100	100	100	100	100
1982-83	109.5	109.8	105.4	107.2	116.6
1983-84	121.6	125.0	120.5	114.5	122.6
1984-85	129.6	130.0	127.7	121.4	128.4
1985-86	132.4	145.0	137.5	133.7	135.7
1986-87	144.4	155.0	144.2	138.9	148.4
1987-88	152.6	153.3	138.5	143.6	161.1
1988-89	160.1	151.2	151.5	154.5	177.1
1989-90	166.9	164.9	174.7	171.7	182.4
1990-91	196.4	188.6	188.7	191.2	190.2
1991-92	218.3	199.0	203.4	207.8	204.0
1992-93	234.6	227.1	225.6	228.7	215.3
1993-94	248.7	250.4	241.5	245.5	233.96

Source: Various issues of RBI Bulletin, Report on currency and finance



Base 1981-82 = 100

Table 4***Movement of Agricultural Parity index in India. 1973 - 1995***

SINo.	Year	Index of Prices paid by farmers	yearly change(%age)	Index of prices received by farmers	yearly change(%age)	agricultural parity index
1)	1973-74	115.5	-	120.5	-	105.5
2)	1974-75	125.5	7.5	125.7	4.1	100.4
3)	1975-76	133.4	5.2	119.2	5.1	96.3
4)	1976-77	150.8	12.9	140.5	16.8	96.5
5)	1977-78	160.1	6.9	148.8	5.5	95.5
6)	1978-79	147.2	8.5	140.2	3.1	98.4
7)	1979-80	182.8	16.5	160.5	7.7	94.6
8)	1980-81	199.3	7.7	185.5	15.7	97.7
9)	1981-82	203.0	2.1	205.0	14.8	100.1
10)	1982-83	210.1	4.4	212.0	3.2	100.09
11)	1983-84	217.7	3.1	248.0	18.9	107.7
12)	1984-85	223.0	2.9	228.5	17.8	101.9
13)	1985-86	230.5	2.8	235.7	3.2	100.7
14)	1986-87	218.5	5.4	215.7	14.9	99.9
15)	1987-88	240.2	10.1	250.5	13.4	103.2
16)	1988-89	235.2	2.1	250.7	0.1	111.8
17)	1989-90	240.4	1.9	240.1	4.0	99.9
18)	1990-91	260.5	8.8	255.2	6.1	95.4
19)	1991-92	280.4	6.9	280.1	6.2	108.8
20)	1992-93	285.5	1.5	290.5	3.2	105.7

21)	1993-94	290.1	1.4	299.9	3.01	102.4
22)	1994-95	299.4	3.01	311.7	4.01	107.7

Source: Various issues of RBI bulletin, Economic survey, Agricultural and Industrial survey

An analysis of movement of the agricultural parity index or the commodity terms of trade shows that the period from 1973-74 to 1991-92 can be subdivided into two sub-groups (1973-74 to 1980-81) and (1981-82 to 1991-92) from the Table it becomes obvious that during period I (1973-74 to 1980-81) the Agricultural Parity Index remained unfavourable to agricultural sector. The average API was 96.4 signifying an unfavourable situation for the farm sector in trade with the non-agricultural sector. For the Indian economy, Tyagi has estimated that during 1964-76, average net barter terms of trade had been little bit favourable to the agricultural sector with a value of 102.3 while for the period of 1976-84 it was unfavourable to the farm sector at 87.0. As in our case first period more or less coincides with that of Tyagi then though we reach to the same conclusion of terms of trade being unfavourable to agriculture but the result of Tyagi seems to indicate much more unfavorable which may be because of heavy prices paid by farmers in the period 1981-84. Thamarajkshi has also estimated that during 1985-75, the net-barter terms of trade was favourable for Indian agriculture. In another study, she has estimated unfavourable terms of trade by the agricultural sector during 1975-84.

A further analysis of the test-indicates that in the period II (1981-82 to 1991-92) the agricultural index has been favourable to the farm sector in most of the years. The average API for this period is positive for agriculture at 103.5. This shows that during second period, though the API may have shown more or less favourable sign to the foreign sector but the index of aggregate agriculture production has not shown any considerable growth. The yearly change in the API was negative on three occasions. Moreover index of price paid by farmers was also negative on three occasions whereas the index of prices received by the farmers was negative on four occasions. Thus we conclude that farmers of India

have been paying much more for industrial goods in comparison to receiving of income from industrial labourers through sale of agricultural goods. Yearly movement of the index of the prices paid by farmers but as a whole we observe only on three occasion in the index of the prices secured by the farmers. From the Test it is found that the unfavourable issue for the agricultural sector continued even beyond 198-81 in few years. This unfavourable situation persisted despite high in the prices received by the farmers. In fact this has neutralised by increase in the prices paid to the industrial sector by the farm sector. We conclude that basically the growth in the agriculturle output and the marketable surplus of foodgrains that turned the agricultural parity index unfavourable to the farm sector in most of the years. On theother hand , adverse terms of trade for the agriculture helped in saving the income level in manufacturing sector of economy.

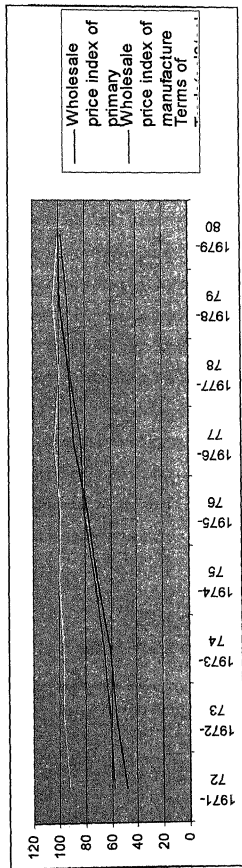
Table 5

Terms of trade derived from whole sale price indexes in
India

SINo.	Year	Wholesale price index of primary	Wholesale price index of Manufacture	Terms of Trade (col3/col4)*100
1	1971-72	48.2	57.4	92.3
2	1972-73	55.3	60.2	96.6
3	1973-74	60.4	65.6	97.4
4	1974-75	70.4	71.8	99.8
5	1975-76	77.7	80.5	98.5

6	1976-77	88.5	82.3	103.3
7	1977-78	92.5	91.4	100.2
8	1978-79	98.4	93.5	104.2
9	1979-81	99.5	97.8	101.1
10	1981-82	100	100	-
11	1981-82	109.5	105.4	103.3
12	1982-83	121.6	120.5	100.1
13	1983-84	129.6	127.7	101.01
14	1984-85	132.4	137.5	104.1
15	1985-86	132.4	137.5	97.6
16	1986-87	140.4	144.2	98.3
17)	1987-88	152.6	138.5	103.3
18	1988-89	160.1	151.5	105.5
19	1989-90	166.9	174.7	96.6
20	1990-91	196.4	188.7	103.9
21	1991-92	218.3	203.4	108.4
22	1992-93	234.6	225.6	103.9
23	1993-94	248.7	241.5	101.8

Terms of trade analysis based upon the ratio of whole sale price index of primary commodities to the wholesale price index of manufacturing commodities from the period 1971-72 to 1993-94, (base year 1981-82=100) though doesnot give any clear trend but we can observe that during 1971-72 to 1976-77 that price terms of trade for primary commodities has, clearly deteriorated and went in terms of industrial goods. But during the immediatly sucesding period 1976-77 to 1984-85 it has improved a lot and worked in favour of primary articles which mainly constitutes agricultural commodities and carries a weight of 41.667.



On the other hand, the many commodities which carry a weight of 49,874 did not show any significant increase in their relative prices (relative to primary articles of which food articles constitute 70% weight) during the period 1976-84. The years 1985-86, and 86-87 were against the farm sector as the average price growth of manufactured commodities started soaring. But it was only temporary and the terms of trade took a new trend reflecting higher price growth of food articles in comparison to many others (including fuel, power and light). Thus as a whole we see that except the period 1971-76 and 1985-87 the wholesale price ratio of the two groups of commodities showed a favourable trend for the primary articles which was mainly due to the rising price of food articles. Anyhow this should not be taken to mean that agricultural output has increased at a faster rate than that of industries. It only means, that farm sector production has been costlier than the non-farm sector. Though this may increase the output on the ground that this is the best incentive to agricultural to put more and more physical and mechanical labour on soil, so as to increase their net disposable income, because of heavy price. But the thing is quite complex to analyse as India being deprived of resource creation may be administering higher prices for agricultural supply to augment production to the desired level. But the farmers may not be in a position to mechanise the agricultural supply because it displaces human labour and also most of our farmers are resource-constrained.

Table 6

Wholesale price Index of Agriculture and Industry in India

S.No.	Year	Agricultural Wholesale price index(1981-82=100) Three yearly moving averages		Industrial wholesale price index (1981-82=100) Three yearly moving averages	
1	1971-72	50.4	-	55.7	-
2	1972-73	55.7	54.9	57.8	58.8
3	1973-74	60.7	62.3	63.8	62.2

4	1974-75	67.3	67.1	67.0	68.1
5	1975-76	74.5	78.5	74.3	78.1
6	1976-77	76.7	79.5	82.9	82.4
7	1977-78	78.5	77.7	88.9	87.5
8	1978-79	81.3	87.3	84.7	86.6
9	1979-80	85.4	84.1	87.7	91.1
10	1980-81	92.7	98.0	98.8	92.3
11	1981-82	100	99.9	100	100.4
12	1982-83	108.7	110.8	105.2	104.1
13	1983-84	112.3	121.4	107.4	110.1
14	1984-85	122.3	121.3	117.7	118.2
15	1985-86	130.5	133.3	129.3	130.3
16	1986-87	145.4	142.2	140.8	136.5
17	1987-88	152.6	156.5	140.5	145.4
18	1988-89	161.0	160.5	151.0	155.6
19	1989-90	167.5	178.4	174.9	167.6
20	1990-91	197.5	202.2	189.5	188.7
21	1991-92	220.3	217.7	203.4	205.7
22	1992-93	234.7	214.4	225.3	224.6
23	1993-94	248.2	244.3	241.1	237.5
24	1994-95	251.9	-	248.8	-

Source: Agricultural survey of India, industrial survey of India, 1980, 1985, 1996.

From the analysis of table- It is observed that terms of trade had gone against agriculture during the period 1973-81. Unfavourable commodity terms of trade as estimated through agricultural parity index during the period 1973-74 to 1980 is also supported by the estimates of whole-sale price indices for agricultural and industrial commodities in India.

Thereafter during the period 1980-81 to 1993-94 the terms of trade has improved in favour of the farm sector. To understand the relative benefits we have calculated three -yearly moving average separately to finally calculate the compound growth rate percent per year. During the period 1971-72 to 1981-82, the compound growth rate for agricultural price index it was 12.5. Further the compound growth rate for the rest of the period 1981-82 to 1994-95, for agricultural sector it was 8.89 and that for industrial sector it was 10.79. It further supports our earlier contention of overall adverse terms of trade for the agricultural sector in India. This signifies that the agricultural sector of India is getting industrial products for consumption and production (for intermediate use for final farm sector production) purposes at relatively higher prices. To make the point more clear, it is to be pointed out that as industrial population (comprising of people engaged in industrial production from a labourer to managing director of a firm) receive income in various forms and spends a part of it upon agricultural consumption and production (raw materials used in agro-based industries) goods similarly, agricultural population (comprising of people from labour to landowner) receives income from the farm sector and spends a part of it upon industrial consumption and production goods. (Agricultural implements like tractors, threshers, tubewells used in the sector to augment production). It implies that if the incomes received by the farm sector is more than the income paid to manufacturing sector then the terms of trade favours the farm sector and if the income paid by the farm people to industrial sector is more than the income received by sale of agricultural consumption and production goods, then the terms of trade would weigh more in favour of the manufacturing sector.

Conclusion

The role of agriculture in developing economics especially in thick populated agricultural economies like that India is by now of great significance. There are links between these diversified sectors not only in product market but also in factor market. Agriculture supplies the major wage-good like food and other items of necessity for the manufacturing sector. Moreover agriculture also supplies raw materials for industrial expansion. Agriculture can also yield an exportable surplus with which the necessary capital goods can be imported for development. The farm sector also provides a market for industrial products both for intermediate and final uses. Intermediate input use comprises basically agricultural modern inputs like tractors, thresher, pumpsets etc which is of vital importance in augmenting farm output. The surplus labour in agriculture is a relatively cheap so supply of this factor for industrial development, can be easily met.

Interrelation between agriculture and industry is also well reflected in financial flows between the two sector. A part of the private investment in agriculture may be financed by external funds from the other sectors of the economy in addition to a net inflow of resources in to this sector on behalf of the government. This investment on government account is a result of a good share of public sector investment being allocated to agricultural and allied activities.

The size of the market which the agricultural sector provides for industrial consumer goods is determined by the proportion of agricultural output marketed to the industrial sector as well as the purchasing power of the agriculturists¹⁵

The demand for agricultural raw materials by the industrial sector (agro based industries) depends upon the input-output ratios in the industries and income levels in the economy. The input-output ratio may further depend upon the degree of technical progress attained in the economy. As the economy develops, the tertiary sector comprising transport,

communications, trade and banking services assumes an expanded role. Thus, there are regularly varying complex relationships between the sectors in the process of growth.

The nature of linkage characterised by these sectors gives a lot of evidence that a rise in agricultural productivity would have to precede or atleast accompany the development of the manufacturing and tertiary sector to attain a significant level of development. An important aspect of intersectoral linkages pertains to the secular changes in the sectoral distribution of workforce and Gross Domestic Product in both case. The share of agriculture is expected to decline as development proceeds. With increasing incomes, the composition of consumer demand would shift in favour of non-agricultural goods and services. The share of agriculture in labour force would also decline with faster expansion of the sectors and with an increase in agricultural productivity.

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5 Sectoral linkages in the Input-Output

5.1 Introduction

5.2 Use of Input-Output technique

5.3 Methodology of Input-Output analysis

5.4 Empirical Analysis of Indian Economy

5.5 Conclusion

5.1 Introduction

The input-output analysis is a practical extension of the classical theory of general interdependence. Whole economy is viewed as a single system for an input-output analysis. This sets out to interpret all of its functions in terms of the specific measurable properties of its structure. Input-output technique has been developed in quantitative form of rows and columns. The rows of table shows the distribution of the output of the sector whereas the columns of the table give the quantity of inputs consumed by the corresponding sector. Thus, broadly speaking, the input-output table shows the flows of goods and services from each sector of the economy to different sectors of the economy over a given period of time. The study of resource flows between agriculture and manufacturing sectors through input-output technique is of vital significance for an optimum level balanced development of both the sectors. Moreover it helps in strengthening the theory of balanced growth¹. It is desired that agricultural and industrial development should not be looked at from competitive point of view. Now what is needed is that both the sectors should be interrelated to the maximum level and their contribution to each other should be maximised. Once again the importance

of input-output technique in this regard become evident. The interrelationship between both the sectors and the extent of their mutual contribution can be best analysed with the help of input-output technique reflected in the resource flows between the two sectors and the percentage of input use by each sector flowing from other sectors.

An input-output table helps not only the expert academicians and the policy makers but also the common man to estimate quickly and have a quite comprehensible idea of inter-industry transaction. Thus an analysis of input-output technique is done to fulfill certain clear objectives. First and foremost objective is to study the quantum of inter-sectoral transactions among agriculture, manufacturing and other sectors. The second objective is to observe the flow of inputs to agriculture from other sectors and flow of output from agriculture to other sectors. The above said analysis further helps in drawing conclusion relating to the extent of interdependence between these sectors over a period of time under study². This also reflects the changing interdependence among various sectors of an economy over a period of analytical study. The theory of balanced growth as contained in input-output analysis helps the policy makers to examine sectoral interrelations and their nature and thus serve a useful purpose.

5.2 Use of input-output technique in India

The importance of input-output technique in India has rapidly increased during the planning period. Its significance has tremendously increased especially during the post green revolution period. In India, some studies have been conducted for constructing input-output table of resources flows between agriculture and manufacturing sectors. Of all these studies, the important ones are by planning division of Indian statistical institute (1951-52, 1953-54), A.K. Chakravarty (1955-56), A.S. Manu and Ashoka Rudra (1960-61), M.R. Saleya (1964-65) and planning commission (1973-74). All these studies seem to emphasize that

industrial development versus agriculture has become the false issue and real issue is inherent in their interrelationship. The study of resource flows between agriculture and the manufacturing sector is now being mainly done through input-output analysis because this reflects the relative importance of each sector and their degree of interdependence which can be used for balanced development of all the sectors of the economy.

The input-output analysis so far done in India has shown that dependence of manufacturing on agriculture is much more than that of agriculture on manufacturing. As far as output of both the sectors is concerned, one-fifth of agricultural output is used by agriculturists themselves for consumption and further production purposes and the rest four-fifths flows to manufacturing and other sectors of the economy. About fifty percent of total agricultural output flows to manufacturing sector. Of the total output of manufacturing sector, generally more than sixty percent is retained by the manufacturing sector itself for its intermediate use. The most notable point is that as against a large percentage (around 50%) of agricultural output flowing to manufacturing sector only a very small portion of total manufacturing output (around 6%) is shared by agricultural sector for intermediate use. Thus, so far analytical studies relating to resource flows from agriculture to non-agriculture and vice-versa with the help of input-output technique in India proves that dependence of non-agricultural sector is more on agriculture as compared to that of agriculture on non-agricultural sectors³. Not only that the relative dependence of manufacturing on agriculture is higher but also the dependence of other sectors (other than agriculture and manufacturing) on agriculture is higher as compared to the dependence of agriculture on other sectors. Of the total output of other sectors more than fifty percent seems to be consumed by these other sectors themselves and about 18 percent flows to agriculture as against 30 percent of agricultural output (which is much larger) flowing to these other sectors.

As far as flow of inputs from one sector to another is concerned, so far input-output analysis relating to inter-flow of inputs among various sectors (agriculture, manufacturing

and others) has proved that manufacturing sector is more dependent on agricultural sector for its inputs. Manufacturing sector supplies only 15% of total input use in agriculture whereas it demands more than one-fourth of its total input from agriculture. But the most mentionable thing regarding inter flow of inputs among various sectors in India seems to be reflected in the heavy input dependence of agricultural sector on other sectors. Agriculture is much more dependent on other sectors for its inputs. Other sectors supply more than 45 percent of total input use in agriculture whereas agriculture supplies even less than 20 percent of inputs to other sectors.

At the institutional level, work on input-output technique in the Indian economy can be associated with the involvement of the planning commission of India³. Input-output table analysis was started by the planning division of the Indian statistical Institute in 1954 and since then work in this field has gained momentum, though beginning in this field was made by Individual researchers around 1951. Among these individual researchers, works of M. Mukherjee (1954), T. Choudhari's 23 sectors model (1954) Biswas (1954), Uma Dutta (1954), Institute of public opinion (1954), W.M. Melbaum (1955) are worth mentioning. But the real boost to work on I.O. technique in the Indian Economy was given by Institutional level work like that of the planning commission of India. Planning Commission's first I-O table consisted of 29 sectors for the year 1959. Thus at the national level, this technique is being utilised extensively by institutions and Individual researchers alike since the early sixties for analysing and prescribing policy framework in the Indian economy.

5.3 Methodology

Input-output analysis is now widely used in India with the basic objective of plan formulations and economic forecasting. It is being used both at the national level as well as regional level in India and abroad. At the outset it may be pointed out that input-output analysis

is a method of systematically qualifying mutual interrelationship among the various sectors of a complex economic system. In practical terms, the economic system to which it is applied may be as large as a nation or as small as the economy of a metropolitan area or even a single enterprise.

In an I-0 table, an economy is divided into a number of sectors under study of homogenous nature. These homogenous sectors are represented in the form of a row or a column in a table. This division of the table in rows and columns with corresponding sectors explains the flow of goods and services either as input or output for intermediate use between all the individual sectors of an economy over a period of time (Preferably this period consist of a year). The row corresponding to a sector gives the use pattern of the total supply of the sectors while a column gives details of inputs absorbed by the sector. With the help of an I-0 table, production and consumption structure of an economy can be understood at any aggregated or disaggregated level according to the nature of required study.

An I-0 table is divided into four quadrants. Quadrant I studies the distribution of that part of output which is absorbed by the producing sectors of the economy. This quadrant is the most important and biggest part of the table as evident from chart I. Quadrant-II shows the consumption by the final consumers. This may be either private consumption or government current consumption. This quadrant also shows the change in capital, net exports etc.

The first quadrant constitutes producing sectors in the form of rows (let it be i) and the input consumption sector in the form of columns (let it be J). This implies that in the first quadrant what is represented is the output of the producing sectors (i th row) flowing as input consumption sectors (j th column). Thus entry into the cell of i th row and j th column is the quantity of output of sector i consumed as input by sector J and is generally denoted by X_{kj} . Total output of sector i is denoted by X_i . Quadrant II constitutes the producing

sector's output (ith row) flowing towards final consumers as opposed to input use as in quaderant I. Thus it is clear that first and second quaderant at the aggregated level distribute the total output of each sector in the economy. Quaderant III consists of the Primary inputs utilised by the different producing sectors. The primary inputs consist of the factor payments to labour and capital, indirect taxes, depreciation etc. Since quaderant I also consist of quantity of input consumption out of the various producing sector's output in the economy, so input consumption is common between first and third quaderant. Therefore quaderant I and III at the aggregated level shows the total quantity of inputs used for final production in the economy. The fourth and the last quaderant represents the flow of above said primary inputs towards final consumers or final demand sectors. As quaderant I and III has one thing in common input use whether primary inputs or the secondary inputs (producing sector's output). Similarly quaderant II and IV have also one thing in common and that is flow of producing sector's output and primary inputs (payment to labour and capital, indirect taxes, compensation for depreciation) in the hands of final consumers. Thus quaderant II and IV at the aggregated level represents the allocation of inputs and output into the hands of final consumers (for private consumption or government current consumption) or in other words into final demand sectors⁴.

5.4 Empirical analysis of Indian Economy

It is now well recognized that industrial development versus agriculture has become the false issue and the concern now is rather with the interrelationships between agriculture, manufacturing and other sectors (other than agriculture and manufacturing) of the economy and the extent of cooperation each can make to other in order to augment production of individual sector and consequently total real production⁵. For this a study of relative resource

flows between agriculture, manufacturing and other sectors of the economy either in the form of input use or for final consumption is essential. This kind of analytical study can be best realised through input-output table. Modern economists have developed this technique in quantitative form of rows and columns. The rows of the table give the distribution of the output of the sector while the columns give the inputs consumed by the sector as evident by the table I.

Table I shows the producing sector's output (represented by rows) flowing to various sectors of the economy in the form of input supply (represented by columns). The quantum of inter-industry transactions among agriculture, manufacturing and other sectors of Indian economy for various years (1973-74, 1981-82, 1989-90) are shown in the table.

A comparison of inter-industry transaction between agriculture and manufacturing as evident from table I proves that the dependence of manufacturing on agriculture is much more than that of agriculture on manufacturing. Agriculture retains around one-fifth of its output whereas, manufacturing retains around 64 percent and sectors other than manufacturing and agriculture retains around fifty percent of its total output. It becomes clear that manufacturing retains major portion (more than three-fifth) of its output. Other sectors use around 50 percent of its total output for itself other as input use or for final consumption. It is also evident from the table that about 50 percent of output from agricultural sector flows to manufacturing and 30 percent flows to other sectors. But the flow of output from manufacturing sector to agricultural sector is meagre (around 6 percent) of total inter-mediate use. It again proves that the dependence of agriculture on manufacturing sector is much less than that of manufacturing on agriculture. Even the dependence of other sectors on agriculture is significantly more than that of agriculture on other sectors. Flow of other sectors output towards agricultural intermediate use is on an average 18 percent where as flow of agricultural output towards other sectors is as much as 30 percent. This implies that agricultural sector is much less dependent upon other sectors than that of dependence of other sectors upon

agricultural sector. In other words dependence of other sectors on agriculture is higher as compared to the dependence of agriculture on other sectors.

From the above analysis relating to one to one inter-industry transaction that is between agriculture and manufacturing as well as between agriculture and other sectors it becomes clear that both sectors-manufacturing as well as other sectors at the individual level are much more dependent upon agriculture as compared to the dependence of agriculture on those two sectors at the disaggregated level. It also implies that if we combine manufacturing sector and so called other sectors as one broad sector on the one hand and the agricultural sector as another big sector on the other, then the dependence of the combined sector (manufacturing plus other sectors) upon agriculture becomes a multiple of dependence of agriculture on this combined sector at the aggregated level. Another thing which is quite analytical is that though dependence of both the sectors (manufacturing and other sectors) at the individual level upon agriculture is more than that of agricultural sector upon these sectors at the individual level but the dependence of manufacturing sector upon agriculture is so much that it encourages for an indepth research.

Now we come to the point of inter-industry resource flows between manufacturing and other sectors. A comparison of inter-industry transaction between manufacturing and other sectors shows that degree of interdependence is almost same between the two. In other words dependence of manufacturing sector upon other sectors in terms of resource flows is almost equivalent to that of dependence of other sectors upon manufacturing in terms of input supply and final consumption demand. Flow of output from manufacturing to other sectors is on an average 32 percent and that of other sectors towards manufacturing is on an average 33 percent of total output. It is clear from the table that share of agriculture in its own input is less than that of manufacturing and other sectors. Manufacturing and other sectors retain almost half of their inputs. The manufacturing industries receives about one-fourth of their inputs from agriculture whereas agriculture receives only 16 percent on an

average of its input from manufacturing. Once again the previous analysis relating to terms of trade between manufacturing and agriculture or in other words input-output resource flows between the two, is strengthened. This proves with still greater analytical power that dependence of manufacturing industries on agriculture is much more than that of agriculture on manufacturing. As far as the input supply relationship between agriculture and other sectors is concerned, agricultural sector is much more dependent on other sectors for its inputs than that of other sectors dependence upon agriculture for its inputs. Agriculture supplies about one-fifth of its inputs to other sectors whereas other sectors supply around 46 percent of its inputs to agricultural sector. When we study the input supply between manufacturing and other sectors on a comparative basis, we come to conclude that dependence of manufacturing upon other sectors for input use is almost same as that of dependence of other sectors on manufacturing for input flow. In other words interdependence between manufacturing and other sectors with respect to input supply is more or less the same.

Thus we have analysed comparative inter-dependence between agriculture and manufacturing, manufacturing and other sectors and agriculture and other sectors with respect to input resource flow from one sector to another. Briefly we can put it this way; agricultural sector is much less dependent upon manufacturing sector (about 16 percent) with respect to input use supply than that of manufacturing on agriculture (about 25 percent), when calculated as a percentage of the respective sector's total input use for final production. As far as interdependence (input resources) between manufacturing and other sectors is concerned, the input supply from manufacturing to other sectors, ranges from 29.5 percent to around 32 percent when observed from the figures given in the three different periods (1973-74, 1981-82, 1989-90). On the other hand the flow of input resources from other sector's output to manufacturing it ranges from 31.40 to 32.33 percent of total input use in manufacturing sector as evident from table I. This reflects that neither of these sectors (manufacturing and other sectors) can be said to be more or less dependent upon another. In broad terms, on an

aggregated basis the interdependence between manufacturing and other sectors regarding one sector's output flowing to another sector in the form of input, is of the extent of around 30 percent of their respective total input use. This implies that, both the sectors, manufacturing as well as other sector's interdependence upon each other for resource flows is almost the same on the percentage basis of their total input use. Now finally we come to the inter-industry transactions relating to resource flows between agricultural and other sectors. Other sectors receive only 20 percent of its total input use from agricultural output whereas agriculture receives about 45 percent of its total input use from other sectors final output. This implies that agriculture is much more than three times dependent upon other sectors as compared to the dependence of other sectors on agricultural produce for their input use⁶.

Resources flows from Agricultural sector to manufacturing and other sector in the form of output and input

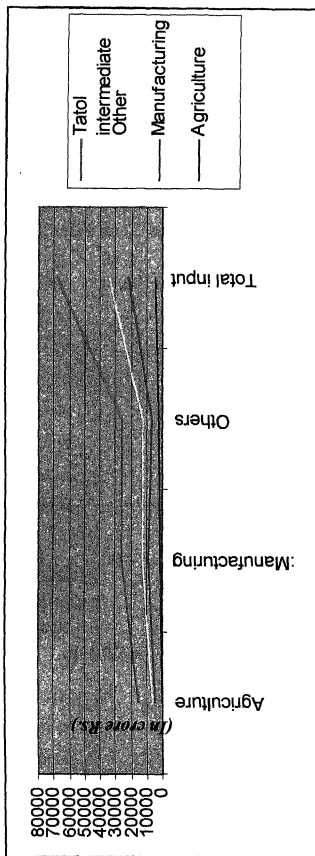
In order to analyse the interdependence between agricultural and non-agricultural sectors, it will be useful to quantify the flow of inputs to agricultural sector from various non-agricultural sectors as well as flow of agricultural output to various sectors. While quantifying the flow of input to agricultural sector, it is important to mention that agricultural sector is not only bestowed with flow of inputs from non-agricultural sectors (manufacturing, animal husbandary and other sectors including Tertiary sector) but also it retains its own output in the form of input to multiply its production process. Input-output analysis of industrial researches as well as institutional research and that of policy makers has made it clear that till 1974-75, Agriculture by itself has met about 39 percent of total input needs. This implies that the role of agricultural sector itself in meeting out its own input needs is much more when compared with the quantity of input supply from various sectors like manufacturing and animal husbandary and tertiary sector.

The previous analysis have been shown that the dependence of manufacturing

, animal husbandry and tertiary sector at the aggregated level is much more than agriculture as compared to that of agriculture on the above said non-agricultural sectors specifically manufacturing sector⁷.

Table II is showing flow of inputs to agriculture from various sectors including the agricultural sector itself. It is evident from this input flow table that manufacturing has contributed about 17 percent of the total input use in agriculture, Fertilizer, Chemicals and pesticides and agricultural machinery in joint supplies by manufacturing. This implies that other manufacturing items like cotton and jute textile, petroleum, industrial machinery for food and textile contributes towards flow of inputs to agricultural sector in a rather insignificant way, if valued in term of quantity. These sub-sectors of manufacturing supply of inputs to agriculture vary nearly about 20 percent. Agriculture by itself has met about 36 percent of the total input needs which is clearly significantly greater than the supply of inputs to agriculture from non-agricultural sectors. Animal husbandry has supplemented over 33 percent of total needs of the agricultural sector which is more or less equivalent in percentage terms when compared with percentage of total input supply to agriculture by the agricultural sector itself. This further means that the primary sector (agricultural sector and animal husbandry) alone meets 69 percent of the input use in the process of production. This high percentage figure (69 percent) flows of input supply to farm sectors from the primary sector is expected to rise further (upto a level of over 70 percent). Among others, the contribution of construction, electricity and trade as calculated in the Table II is relatively high and they continue to play a significant role in the development of agriculture. However, communication and banking contribute & about 30 percent of the total inputs supplied by others. The other sectors that is construction, electricity, trade, banking, communication etc. constitute around 22 percent of the total input supply to agriculture. In this 22 percent of the total input flow to agriculture, the Industrial contribution of sub-sectors of this so called other sectors may also be given analytical importance.

Construction industry contributes 24 percent, electricity contributes 17.08 percent



and trade 29.5 percent which is larger than other remaining sub-sectors of other sectors. But if we observe the contribution of communication and Banking in aggregated form then it is relatively higher than contribution of construction and electricity.

Table 1

Inter-industry Transactions(in cores Rs.)

Sector	Agriculture	Manufacturing	Other	Tatol intermediate
Agriculture	187.12	4217.64	2511.78	8596.54
	(21.72)	(49.06)	(29.22)	(100.00)
:Manufacturing	736.19	8032.34	3991.28	12759.81
	(5.77)	(62.95)	(31.28)	(100.00)
Others	2183.98	4045.17	6530.65	12759.80
	(17.12)	(31.70)	(51.18)	(100.00)
Total input	4787.29	16295.16	13033.71	34116.15
1981-82	(14.03)	(47.76)	(38.21)	(100.00)
Agriculture	5490.72	12218.74	7311.77	25021.23
	(22.12)	(50.07)	27.81	(100.00)
Manufacturing	2272.70	24537.39	10997.38	37807.47
	(6.02)	(61.90)	(32.08)	(100.00)
Others	6584.99	12385.99	18488.74	37459.72
	(18.01)	(31.40)	(50.59)	(100.00)
Total input	14348.41	49142.12	36797.89	1000288.42
1989-90	(15.05)	(50.81)	(34.14)	(100.00)
Agriculture	16680.80	37219.73	22311.79	76212.32
	(23.11)	(51.08)	(25.81)	(100.00)
Manufacturing	7270.77	72633.40	33996.39	63900.56

	(8.00)	(62.30)	(29.50)	(100.00)
Others	19581.98	38485.90	57487.77	115555.65
	(15.01)	(32.33)	(52.60)	(100.00)
Total input	43533.55	148339.13	113795.95	305668.63
	(14.77)	(49.23)	(36.0)	(100.00)

Table 2

Flow of input to agriculture from various sectors (1989-90)

Sector item	Food crop	cash crop	plantation crops	Other	Total
Agriculture	1141036	241368		215380	1597784
	[44.4]				[36.21]
(a) Food crop	1084311			17663	1101974
(b) cash crop	1013	280015		7311	288339
(c) other crop	30715			191312	222024
Animal	1144310	251218	24313	291314	1611155
Husbandry	[30.35]				[32.99]
Manufacturing	433511	181912	21580	133311	670314
		[14.08]			[16.99]
(a) cotton and jute textile	4112			112	4224

(b) petroleum	112380	12640		22314	147334
(c) fertilizers	270312	81319	6012	82418	440061
(d) pesticides	12250	92412	17744	26313	148719
(e) agricultural machinery	21140	3460	240	5623	30763
(f) industrial machinery	11120			101	11221
others	414381	145250	34220	98880	692731
	[21.92]				
(a) construction	120123	21365	830	31333	173651
(b) electricity	92782	22224	45	17412	132463
(c) transport	57862	22775	2445	16192	99274
(d) communication	1692	255		344	2291
(e) trade	93625	61645	6981	31834	194085
(f) banking	40534	28175	23912	5845	98466
Total input	3.133238	819748	80113	738885	4571984

Source : Agricultural survey (1985, 1986, 1987) and industrial survey (1986, 1988

Table 3

Flow of agricultural output to various sectors(1989-90)

	Sector/item	Food crops	cash crops crops	Plantation	Others
I)	Agriculture	1389645 [66.02]	255477 [8.01]	-	222013 [8.8]
a)	Food crops	1372015	1124	-	37134
(b)	Cash crops	-	247688	-	-
(c)	Other crops	17633	6677	-	184888
II	Animal Husbandry	490018 [22.88]	62015 [1.90]	-	1955267 [68.33]
III	Manufacturing	138966 [6.61]	3077945 [90.09]	276890 [100.00]	547000 [18.77]
(a)	Sugar	55	542850	-	5130
(b)	Food	122413	1156344	219153	379690
(c)	Beverage	230	-	-	8433
(d)	Cotton/jute textiles	4311	1170070	-	2245
(e)	Other Textile product	99	13755	380	10694
(f)	Wood and wood product	-	312	-	1200
(g)	Paper and paper product	370	-	-	8543
(h)	Leather and	165	-	369	817

	leather product				
(i)	Plastic & rubber	-	12	54954	-
(j)	Chemicals and pesticides	11194	11966	2050	98177
(k)	Miscellaneous	150	44	-	4565
IV	Hotel and Restaurant	4.40	-	-	84850
		92001			[3.81]
	Total intermediate use	2110638	3395437	276890	2809130
		[100.00]	[100.00]	[100.00]	[100.00]

Source : Agriculture survey (484-870), industrial survey (1986-87) figures in parenthesis are percentage to total intermediate-use.

Linkage coefficient (Forward and backward) between agriculture and manufacturing

Two different measures are used to determine the extent of linkage between agriculture and manufacturing .In other words relative strength of production linkage between agriculture and manufacturing are determined through two different measures. It helps us in identifying the important manufacturing that depend on agriculture for its inputs and that supply input to agriculture. It also assists in determining the magnitude of the inter-industry transactions taking place in the economy as a whole.

Production linkage between agriculture and manufacturing can be subdivided into two types (a) Backward linkage (b) Forward linkage . In measuring the backward linkage from agriculture, the total purchase of agriculture from manufacturing as a percentage of total manufacturing output and total agricultural input is taken into account. The other method to measure the backward linkage is to find out linkage coefficient. Agricultural sector's forward linkage is also measured in the same process. First of all the total intermediate sales of agriculture to manufacturing as a percentage of total manufacturing input and as a percentage of total agricultural output is taken into account, then after the linkage coefficient

in the forward direction is found . Thus systematically we can arrange the method of measuring backward and forward linkage as follows.

(1) To measure the backward linkage (agricultural sector).In measuring the backward linkage from agriculture we have to work out two step.

(a) Firstly, we have to calculate the total purchase of agriculture from manufacturing in percentage terms. This should be a percentage of total manufacturing output.

(b) Secondly agricultural sector should purchase from manufacturing should also be calculated as a percentage of total agricultural input itself.

(c) Finally we will be in a position to work out backward linkage coefficient for agricultural sector.

(2) To measure forward linkage for agricultural sector means what it sells to other sectors (here, manufacturing) or in other words what it supplies to manufacturing forward linkage for agriculture implies what is forwarded by agriculture to manufacturing sectors for its input uses. This again is calculated into various intermediate steps.

(a) Firstly we calculate the total intermediate sales of agriculture to manufacturing as a percentage of total agricultural output itself.

(b) Secondly we find out the total sales of agriculture to manufacturing as a percentage of total manufacturing input.

(c) Finally we enter an stage to find the agricultural sector's forward linkage coefficient.

Mathematically, calculation of forward and backward linkage coefficient between the two sectors can be summed up as follows.

Let I and J be two sectors

(I = agricultural sector and J = manufacturing sector)

Let $x = \sum_i, \sum_j, \sum_{ij}$ and input-output transaction matrix of rank (n x n), where x_{ij} refers to Ith sector demand for inputs from sector J :

$$\text{Thus a. Back ward linkage in sector J} = \frac{\sum_i x_{ij}}{X}$$

$$= \frac{\text{Total intermediate inputs of sector J}}{\text{Total output of sector J}}$$

$$\text{b. Forward linkage in sector I} = \frac{\sum_i x_{ij}}{D_i}$$

$$= \frac{\text{Total intermediate demand for the output of sector J}}{\text{Total demand of sector J}}$$

The table IV shows the dependence of agricultur on agro-input manufacturing industries which we term as backward linkage from agriculture. This shows to what extent manufacturing sectors contribute towards the total input use in agriculture,. It is evedent from the table that manufacturing sector supplies inputs to agriculture in respect of Food crop in higher percentage as compared to other crops. Among different crops , food crops had the highest backward linkage coefficient (0.277) and the lowest for other crops (0.075) . But what is more important is that on the whole the backward linkage for agricultural sector from manufacturing ie the flow of agricultural input through the manufacturing output, is found to be very weak. As is evident from the table that the Agriculture's backward linkage as a whole is of very low order (0.177) which is much weak than the specific backward linkage for food crops (0.277) . Agriculture's forward coefficient was relatively stronger than the backward linkage. Cash crops had the highest forward linkage implying that cash crop of agricultural sector provides a highest percentage of total input of manufacturing sector as compared to other kind of crops contribution towards the input supply to non-agricultural sector. Cash crop have been so far providing the largest quantity of output flow

to manufacturing the input use in the latter. The forward linkage coefficient was valued at 2.3501 for cash crop with the linkage coefficient of other crops like food crops, plantation crops was Calculated at much lower figure. This should be taken to mean only that manufacturing sector is provided input supply by cash at a large scale only as compared to other agricultural crops and not as compared to the input supply by the manufacturing as compared to the input supply by the manufacturing sector itself.

Table 4

Linkage between agriculture and the manufacturing sector

S.no.	Particulars	Food crop	cash crop	plantation crop	others	total
(1)	Backward linkage from Agriculture (a) total purchase of agriculture from manufacturing sector as a percentage of :					
	(i) Total output of manufa- cturing sector	1.75	0.74	0.11	0.47	3.001
	(ii) Total agricultural input(total input used by respective crops)	11.70	26.70	27.10	28.94	14.99
	(b) Linkage coefficient	0.277	0.1476	0.1444	0.075	0.177
(2)	Agricultural Forward Linkages (Back-ward Linkages from manufacturing sector) (a)Total intermediate sale of agriculture to manu- facturing as a percentage of :					
	(i)Total agricultural output	1.33	50.29	39.23	6.67	10.92

(total output value of respective crops)

(ii) Total input of manufacturing sector	0.71	9.40	1.41	2.38	13.68
(b) Linkage coefficient	0.177	2.3501	0.502	0.641	0.446

Source : Calculated with the help of formulae already mentioned for forward and backward linkage coefficient on the basis of input-output supply by both the sectors in 1989-90.

With the help of data in various issues of industrial and agricultural journals.

Forward and backward linkage coefficient for agricultural sector has been already employed and analysed in detail including the mathematical formulae and input-output resource flow between manufacturing and agricultural sector with special reference to the year 1989-90. One thing which still remains to be pointed out is that agricultural sector's forward linkage (its output sold to or flowing to manufacturing for input use and have to add value in the final production) is the backward linkage of the manufacturing sector as the latter demands it from the agriculture in the form of a certain percentage of its total input use. Similarly agricultural sector's backward linkage (its demand for manufacturing sector's output to use it as input or value added so as to augment its final production) is also manufacturing sector's forward linkage because manufacturing sector is the supplier of a certain portion of its output to agriculture for input use in the latter. Thus backward linkage-coefficient for one sector, say agriculture is the forward linkage coefficient for another, say manufacturing.

Investment decision and linkage coefficient

From the above empirical analysis it is clear that economic progress at the macro level depends on the interaction and mutual development of agriculture and industry, changes in the growth pattern of one sector affect the growth of the other sector. It should be pointed

out that balanced growth of various sectors is desirable to achieve maximum possible growth of the economy as a whole. The studies undertaken by economist like Rostow, Hirschman and Chennery revealed that in the process of development, certain sectors play a crucial role. It is believed that the causative factors of economic development may be discovered by studying the inter sectoral linkage. In terms of comparison linkage coefficient between various subsectors of economy like textile, grain, mill products, electricity, mining, machinery, transport equipment etc we analyse that in the criterion of total linkage score, textile and grain mill product are more important than electricity, mining, machinery and transport equipment including agriculture. Chennery has been suggested that investment decision should be based upon value of linkage coefficient. If we follow Chennery's advice then Textile and grain mill products should be allocated higher percentage of investment than that of other (electricity, mining, machinery, transport equipment including agriculture). This implies that investment decision based on total linkage sectors, may actually retard economic growth instead of promoting it. This yardstick of investment allocation would result in imbalance leading to not only stagnation of agriculture but also retardation of complete growth process. Hence it is desirable for policy formulation to avoid the criticism of total linkage score in deciding the allocation of investment. In other words, linkage coefficient of sub sector of the economy should not be treated as yardstick in deciding the pattern of investment. But this should not be taken to mean that concept of intersectoral linkage and their measurement is altogether unimportant for investment decision.

What is meant to say is that investment decision whether intersectorally or intra sectorally should not be exclusively relied upon the comparative value of linkage scores of various sectors or sub sectors of the economy.

Conclusion

The resource's flow analysis between agriculture, manufacturing and other sectors like construction, electricity, Transport, communication trade, banking etc. aims at not only simply drawing conclusions relating to the extent and direction of their interdependence, but it also helps in the process of balanced development of these sectors. Thus it helps in strengthening the theory of balanced growth. The theory of balanced growth as compared in input-output analysis is important for analysing a wide range of empirical problems connected with planning.

A comparison of inter-industry transaction between agricultural sector and manufacturing sector (mainly constituting cotton and jute textile, petroleum, fertilizer and machinery) shows that the dependence of manufacturing on agriculture is much more than that of agriculture on manufacturing. Agriculture retains about 20 percent of its output and manufacturing retains about 60 percent of its output. About one half of its output from agricultural sector flows to manufacturing, whereas the flow of output from manufacturing and agriculture is of very low volume (about 6 percent of the total intermediate use).

As far as interdependence between agricultural sector and so called 'other sectors' relating to mutual supply of input being the output of another (backward linkage of one sector being the forward linkage of another) is concerned it is concluded that agriculture is much more dependent upon other sector for its input (more than 55 percent) whereas it supplies 20 percent of its input to other sectors. But if we look at this inter-industry resource flow as a percentage of one sector's output flowing to another sector then the dependence of other sectors on agriculture is higher as compared to the dependence of agriculture on "other sector".

When we compare the manufacturing with other sectors (including service sector) we conclude that the extent and direction of their interdependence in both cases whether as

a percentage flow of output of the producing sector to the receiving sectors or as a percentage of the total input use of the receiving sector is almost the same. In other words the degree of interdependence is same between the two as the flow of output from manufacturing to others (31.3 percent of manufacturing output) is equivalent to that of that other sector's to manufacturing (around 32 percent of other sector's output). Finally, comparing manufacturing with other sectors relating to total input percentage of the receiving sectors, we can say that their inter relationship with respect to input supply is more or less the same . As far as linkage coefficient between agriculture and manufacturing is concerned, agriculture's forward linkage was relatively stronger than the backward linkage.

Notes and Reference

1. Nambodari , 'The Production Linkages between Agriculture and the Manufacturing Sector Indian Journal of Agricultural Economy', 92.
2. Kindleberger, Charles P., 'Economic Development' (Mc.Graw Hill Publishers , New York) 223.
3. The important studies are by planning division of Indian Statistical Institutes (1951-52, 1953-54), A.K. Chakravarti (1955-56).
4. This is concluded from the input-output study of A.S. Manu and Ashoke Rudra (1960-61) and M.R. Saleya (1964-65) with special reference to backward and forward linkage.
5. Manufacturing industries represents the secondary sector which includes electricity, construction, gas and water supply.

6. Other sectors refers to all other sectors excluding agriculture and the manufacturing sectors. At the institutional level the important studies of input-output analytical approach between agriculture, Manufacturing and other sector includes the study of planning commission (1959) and the planning decision of Indian Statistical Institute since the beginning of planning era.

6 Inter Sectoral Linkage under the Plans

In the early years of Planning agricultural production had recorded growth rate as high as 3.57 percent per annum. This agricultural growth rate was correspondingly associated with a 7.2 percent growth rate in the index of industrial production. This resulted consequently in more or less near stability in the net barter terms of trade. Subsequently during 1951-52 to 1960-61, the terms of trade showed an impressive improvement in favour of agriculture after which it considerably deteriorated in the period 1961-62 to 1970-71. Within the phase of deterioration however, there is some improvement since 1971-72. In these two periods, both agricultural and industrial production have maintained their rising trend, although at a rather lower rate than during pre-independence period. Taking into account the increase in sales by agriculture in this period, the income terms of trade have improved in 1968-69. Compared to 1960-61 but have increased in comparison to 1973-74. Moreover terms of trade has also improved in 1978-79 compared to 1960-61.

The improvement in income terms of trade for agriculture in 1978-79 vis-a-vis 1960-61 was marginally less than that for non-agriculture. Between the deteriorating and improving phases of terms of trade, growth of savings rate of household sector did not show much variation. It was, however highest in the first phase when both agricultural and industrial production had shown the highest rate of growth. A good share of public investment has gone into agriculture over the years and this sector has been influenced by a positive policy package.

Between 1951-52 to 1971-72, the total domestic capital formation in agriculture at 1970-71 prices was of the order of Rs. 40,000 crores. In 1971-72 the share of agriculture in domestic capital formation in the economy was 15 percent.

Over the first three plan periods a sum of Rs. 8114 crores was incurred for agriculture and community development constituting 11 percent of the total plan expenditure. In addition,

the outlay on irrigation and flood control in different plans has on an average accepted for 10 percent of the total plan outlay. Also during last five years or so, the estimated irrigation loss on account of the low irrigation rate was nearly Rs. 3170 crores. While the total expenditure due to fertilizer subsidy during 1977-78 to 1985-86 was around Rs. 6900 crores, Agriculture has been effectively put outside the purview of direct taxation.

Normally changes in the terms of trade should reflect underlying structural change in the relationship between agriculture and the remaining sectors of the economy, when the economy is fairly advanced and agriculture has reached a high technology status, a situation of plentiful supplies of agriculture may arise with reference to a more or less stabilised demand for food and other agricultural raw materials with the result that their agricultural prices would get depressed leading to a deterioration in terms of trade. In the light of the trends in the inter-sectoral terms of trade since 1973-74 the question is whether Indian agriculture has reached such a state¹. Agriculture has no doubt undergone an impressive degree of modernisation with the share of inputs such as fertilisers pesticides and insecticides electricity and diesel oil in the total inputs used in agriculture having almost doubled in real terms in a matter of 10 years or so from 17 percent in 1970-71 to 27 percent in 1981-82.

During Fourth Plan period the demand for non-agricultural products by agriculture has risen at a faster rate than the demand for agricultural products by non-agriculture has not maintained an accelerated growth rate. The growth of agricultural production, although commendable in itself, is yet less than that needed for meeting the economy's requirements of food grains and raw materials. To a considerable extent, the induction of modern inputs has been made possible by Government's intervention in terms of a positive price policy for agricultural commodities and also concessional electricity rates and water rates. Fertilizer subsidy ranked superior to all incentives provided to agricultural land farmers (small and marginal) as well as tenants, but one notable point in this regard is that, this has not shown itself in a proportionate betterment of the agricultural performance. The phenomenal increase in the consumption of modern inputs by agriculture pushed up the prices of these inputs

without commensurate increase in agricultural production. If agricultural production would have grown at a faster rate, it could have almost strengthened the process of industrial growth. This would have further resulted in the slashing of industrial prices and resulted in a different relative price ratio of the two sectors.

During the Fifth Plan period Agricultural sector and non agricultural sector comprising of manufacturing, construction and other services, both have recorded considerable expansion in production². But when we analyse this expansion in a comparative and competitive way, we conclude that, industrial production has been growing much faster than agricultural production. Inter-year fluctuations have characterised the behaviour of agricultural production but the peak-to-peak improvement has ranged between 10 to 14 percent in the years of fifth and sixth plan period.

In the Sixth Plan period, the Industrial production has been found to be more correlated with agricultural production as compared to fifth plan period though there has been some inter-plan period fluctuations regarding the degree of correlation between Agriculture and non-agriculture while factors such as the pace of public investment and nature of import substitution policy are relevant in analysing industrial production trends³, the fact remains that a 9 percent growth in industrial production was associated with a 4.6 percent growth in agriculture production during the Sixth Plan period. There has been no marked change in the sectoral distribution of work force corresponding to the visible decline in the share of agriculture in the gross domestic product. An impressive dynamism is observed in the exchange of products between these two sectors specifically in the sixth plan period. Both sales and purchases of agriculture vis-avis non agriculture have grown faster during 1980-89 compared to earlier period of third and fourth plan. However while this rate of growth of sales was faster than that of purchases on the earlier period, the position was reversed in the latter period with purchases growing faster than sales. More importable purchases by agricultural sector of modern inputs from non-agriculture for intermediate uses turned them selves during the period of Fifth Plan period to seventh Plan period. At

current and at constant prices agriculture was a net importer in 1978-79. There have been three phases in the long term trend in the net barter terms of trade. Agriculture has received a good share of public investment and been influenced by a positive policy package. Despite the phenomenal rise in the modern inputs in agricultural the productivity of these inputs has shown a marked decline. The deterioration in the terms of trade since 1977-78 is perhaps more a reflection of an aggregated demand for modern inputs by agriculture than of plentiful agricultural supplies⁴. With the large use of modern inputs, agricultural production could have expanded at a faster rate and strengthened the process of industrial growth which would have resulted in a slackening of industrial prices and a different relative price ratio between the two broad sector of Agriculture and non-Agriculture.

Now we come to a brief analysis of last two decades of planning specially with emphasis on agriculture-industry relations, the resulting hypothesis examined and the long-term stagnation in Indian Economy is traced back primarily to the planning model. We often adopted alternative planning strategy emphasising the wage-goods model as suggested by policy. The growth process in Indian Economy has been marked by a disequilibrium between industry and agriculture resulting from the transformation, of top-heavy industrialization accompanied by a sluggish and indigeneous growth of the priority sector. The consequence has been a mismatch of and between laid targets and a slowdown of growth rate. The planners have given more importance to a balanced growth process in several plans documents with a direct emphasis towards a heavy-industry first type of investment to enhance and augment the speed of development and encourage the growth advancement at a faster rate. This implies that though agriculture was provided a complementary production with industrial sector in the 1980s but still it was characterised by a relative neglect of agricultural sector whose dynamic expansion is crucial in the context of Indian economic development. The continued imbalance between these two sectors of the economy deliberately created unbalanced planning process and kept the economy away from the steady state growth path. These are the basic reasons as to why Indian economy has been facing deterioration in the growth process in real terms.

In the earlier years of planning the emphasis on the primary sector has certainly enhanced the net availability of the agricultural produce which could give a boost to the agro- based industries while weight attached to the manufacturing sector has come down. It is mostly due to the lower importance claimed by agro based industries. Manufacture of textiles, the single biggest manufacturing industry in the country has suffered a big reduction in weight from 28 in 1960 to 18.7 in 1970. Similar is the case with food manufacturing. The material consumption pattern of new group of industries is entirely different. Instead of depending upon agriculture it emphasizes inter-industry relationships. Inputs required by the industrial sector will increase. It tends to be supplied from within the industrial sector itself. The rate of agriculture as a raw-material supplying agency to industry is likely to come down further with the expansion of group of industries.

During the Sixth-Plan period the trend in private final consumption expenditure was almost exactly the same as that of induced agricultural production, only the difference being that peaks and the trough variable happen to be less prominent. It is clear that pattern of private final consumption expenditure in this country is still very much determined by the trend of agricultural production movements in agricultural and industrial production. It bears no such correlation or associated short fall in agricultural production. It may have led to changes in output since selected group of industries as indicated by the data relating to sixth Plan period with special reference to price index of both the sector. But it also indicated that overall index of industrial production is not affected. The annual percentage changes in agricultural and industrial production and private final consumption expenditure also supported this conclusion.

Sixth Plan period also observed growth rate of manufacturing sector as compared to fifth plan. Manufacturing sector contributed about 18 percent of the total input use in agriculture. Agriculture by itself has met about 40 percent of the total input needs and animal husbandry has supplemented over 33 percent and it implies that the primary sector alone meets over 70 percent of the input use in crop production Fertilisers chemicals and pesticides

and agricultural machinery account for about 78 percent of the total input supplied by manufacturing. Among others, the contribution of construction, electricity and trade was relatively high and they continue to play a significant role in the development of agriculture.

As far as the development of linkage between the agriculture and industry in the seventh plan period is concerned it has strengthened during the period 1986-89 at its maximum point. About 50 percent of the agricultural output had flown to manufacturing and other sub-sectors of industries. The other half of the agricultural output was retained by the primary sector itself which includes crops and animal husbandry. It is doubtless that there should be other non-priority industries experiencing similar higher growth rates. Presumably those are not industries which cater to the needs of mass consumption or meet the input requirements of agriculture. They are meant to satisfy demands coming from a specified section of the people. Agriculture as is well known in addition to meeting of food requirement of people has also increased the proportion of supplying inputs to agriculture and industries by about 33% in the seventh plan. Now in this country, industries depending upon agriculture for raw material supplies are quite a few in numbers namely food, manufacturing, tobacco manufacturing of textiles etc. But these are all traditional industries in the country. The new group of industries that has come into prominence only during the plan period namely chemical industries, Petroleum industry, steel and various non-ferrous metal industries, machinery and machine tools industry done of depend in the least for their raw material supplies upon agricultural sector.

As seen in the seventh plan period it is analysed conclusively that the sign of the annual percentage change in final consumption expenditure seems ultimately to depend on the relative stranghts of changes in agricultural and industrial production respectively but the causal relationship the observed change in private final consumption expenditure. How far it is caused by annual percentage change in industrial or agricultural production cannot be ascertained by merely comparing the signs. It only indicates the occurrence of simultaneous changes but since major part of the yearly changes in material income is accounted for by

changes in income arising in the agriculture sector, role of agricultural production in deciding final consumption expenditure cannot be over emphasized.

In the context of experience of planned development efforts specifically in the eighthth and ninth - plan periods (1985-1997) the inter-dependence between the agricultural and manufacturing sectors assumes a paramount importance. This interdependence is largely determined by the essential requirement of smooth and regular supply of inputs for the one while they are outputs of the corresponding other sector. Moreover it can be emphasized that forward and backward linkages between the Agriculture and industry should be strengthened further in the future plan periods so as to reap the fruits of balanced sectoral and regional development reducing the inequality of income and wealth between the farm and non-farm people. These two sectors should be viewed also in terms of an integrated approach in so far as the employment aspect and manpower requirement are concerned. The meaningfulness of the inter relation between the two sectors is reflected in the need for the diversification of the national economy in a way that it can withstand the vicissitudes of the frequent changes in the world trade and monetary systems. The more or less substantial growth in the two sectors experienced in India during the planning period before the eighth plan period have been the results of the lack of the desired integrated approach towards development of these two sectors. The emergence and persistence of such shortages or bottlenecks may in course of time, may lead to upward sloping in costs and hence price while in turn may upset all plan estimates.

A balanced growth of these two important sectors of the Indian economy should be with guideline for development plans. The relationship between agriculture and industry can be viewed as one of interdependence implying thereby that equal importance should be given to their assimilating development⁵. Industrial development is a synonym for economic development and neglect of industrial development will mean continuance of backwardness of Indian economy. One view relate to the perspective in which agricultural development is given top priority in the plans. The other view relates to the top priority to be given to

industries. All these views have been examined and it has been found that the arguments weigh in favour of the interdependence of agriculture and industry in India. Yet the problems of overall choice of production technique remains.

In the Eight Plan period the Industrial policy makers explained the prevailing tendency relating to linkage between farm and non-farm sector by policy makers that the agriculture - industry linkage has significantly differed as the agricultural development has preceded industrial development in impression with a situation when both the sectors have expanded considerably. A number of effects like competition between agriculture and industry for natural resources, change of agricultural pattern etc. are traced when industrialisation takes place. The conditions under which industrialisation may contribute to the development of agriculture have been analysed for analysing balanced backward and forward linkage between the two sectors. The type of industrial development is quite significant in this context. It is desirable that more agro-based industries are given preference over any other type of industries. Many important areas of complementarity and substantiality alongwith the areas of competitiveness between agriculture and industry has been pointed out. The contribution of agriculture to industrial development is shown to be subject to a purchasing power constraint. An analysis of cash earnings and disbursement pattern enables us to identify the areas of complementarity and competitiveness if it is suggested that the agricultural strategies pursued must attain three major objectives. First is to promote overall economic growth and structural transformation to take advantage of the positive interactions between agriculture and industry. We have also to achieve broadly based improvement of the welfare of the rural population. The first and foremost objective is to have a favourable impact of changes in attitudes and behaviour and on institutional progress.

In the Ninth Plan Period it was recommended that in order to maximise the level of inter linkage between the two sectors and to make them development oriented not only for themselves but also to increase their pushing forward efficiency for each other, a bimodal strategy of progressive modernisation for both the sectors should be adopted. This bimodal

strategy was in comfort to the unimodal strategy of seventh and Eight Plan period in which it was recommended that a progressive modernisation of agricultural sector may be implemented profitably.

For the Ninth Plan period's policy formulation regarding the strategies of agricultural and industrialisation progress it was pointed out that mere blind faith in industrialisation will not help India since development is not synonymous with industrialisation nor agricultural progress alone can fetch anything better than crawling economy through in the short run unimodal strategy for promoting either of the sector exclusively and assuming the development of the other sector automatically may to some extent prove worth while⁶. But in the long run, it is the reciprocal interaction between these two sectors that must guide the policy makers in evolving a strategy for most balanced and optimum level of linkage thereby resulting in higher growth and development of the country as a whole. It also has been observed that agro-industrial strategy would ensure a high rate of economic growth by opening up opportunities for employment through a better and fuller combination of industrial and agricultural activities as far as possible near the rural areas themselves. An increased balance between agriculture and industry will hasten the prosperity of the backward regions as Bazaanti observes that there is no hope outside a well balanced cooperation of agriculture with industry. Agricultural advancement is practically impossible unless it is paralleled industrial advancement utilising local resources.

From the above plan wise analysis we conclude few things. First is that there is a direct link between agricultural increase and industrial development. Secondly during the planning period it has been observed that agricultural and industrial prices in India have shown definite trends. A scissor like trend during the first plan and second plan period has been seen on the other hand in the third plan and the three annual planning period (1960-65 and 1966-69) higher prices for farm output per unit in comparison to the prices of industrial goods per unit has been indicated. This consequently lead us to conclude that during the period of first three plans and alongwith three annual plans, there was a more favourable

term of trade for agricultural sector in an industrial growth strategy a favourable terms of trade for agriculture does not sustain itself as it means that resources would flow to a less profitable and more supply sector, which is not subject to increasing returns to scale. The common argument is also that the income elasticity of demand for food is less than unity while non - agricultural goods are income elastic. It may be noted that favourable or unfavourable terms of trade is not an end in itself. The more important question is whether it leads to favourable output responses in agriculture and industry. That is why in the fourth and fifth plan period merely sketching out the price indices for the two sectors and their competitive growth toward sloping of either of the two sectors was not treated as the significant indicator for the development of the economy as a whole. As Risardo has pointed out that till there is fertile land left, a relatively lower price of agriculture would boost industrial production, by way of cheap raw material would support cheaper agricultural goods and so the present trend in India of a constantly increasing relative prices of agriculture may be growth retarding.

Agricultural prices as a percentage of non-agricultural prices has been moving round 110 as witnessed by recent plans (1985-1997). It is justified on the ground that falling agricultural price, make the term so trade favourable to industry due to falling prices of raw materials, while food prices are independent variable to industry. Thus the loss here is a loss to raw material farmer and not to the food farmer. Further the food prices have shown lesser volatility than raw material prices during falling prices. The effect of food prices on industrial wages is therefore indirect but mildly positive, A steeper rising trend of prices of both the sectors is also not appreciable as observed in the eight plan period. Though during the post reformation years (1990-91 onwards) there has been a lot of improvement in the relative price indices of both the sectors as well as when either of the sector viewed exclusively.

Conclusion

The role of agriculture and industry in the development of an economy should not be seen as competitively but rather their interdependence and intersectoral linkage of are sector upon another should be analysed and there by strengthened in order to realise balanced development of these sector's which is vital significance for optimum level growth of an economy as a whole. A study of the interrelationship between agriculture and industry is important determine the relative forces of intersectoral demand and supplies of resources, product and factors.

An analytical study relating to interrelationship between agriculture and non-agriculture sector shows that there are links between the two sectors in the product and factor markets. Agriculture supplies the major wage-good ie food and supplies raw materials for industrial sector. Agriculture also plays a significant role in India's exports. It can help in yielding exportable surplus with which the necessary capital goods can be imported for development. Moreover industrial sector finds a big market in the form of its purchasers of consumer and capital goods on the demand side of Agricultural sector. That is to say that agriculture provides a market for industrial products both for intermediate and final uses, the surplus labour in agriculture is can be out flowed to industrial sector. Agriculture not only supply provides industrial sector with labour (being surplus in agriculture) but also this is a relatively cheap source of supply of this factor for industrial development. On the other side, Agricultural sector can also absorb such group of labourers who get out of industrial sector due to shut up of factories as a consequence of aggregate demand falling of production level. Thus there could be in-migration of labour into the agricultural sector during periods of a down swing when this sector acts as the alternate shelter for those who fall back on land farm paint of new.

Agriculture sector and the non-agricultural sector (Manufacturing, construction, trade, services, electricity etc.) are also inter linked with each other in respect

of financial assets and liabilities. A part of the private in agriculture may be by 'external' funds from the other sectors of the economy in addition to a net inflow of resources into this sector on Government account consequent to a good share of public sector investment being allocated to agriculture and allied sectors, rural development and irrigation. Though both the sectors are depending upon each other for their financial need but agriculture is general more dependent upon the non-farm sector for financial assistance. Apart from this savings of industrial sector-related people is higher than that agriculturists, Moreover government of India gives it a considerably higher percentage share in its investment plans as compared to industrial sector because of being treated as priority sector . Generally the Agricultural loans are provided by Banks and other financial institutions at a much lower rate than that of provided to manufacturing sector. Thus a different interest rate structure also waste in favour of the farm sector and it allied. The growth of agricultural incomes over time has been quite meagre .Tremendous strides were made in specific regains and particular crops. These progresses have not been sufficient to solve the problem of slow growth of agricultural incomes. This problem has not found any remedy even the extremely valuable effects of Green revolution. While tremendous strides were made in specific regions and particular crops-reflecting the extremely valuable effects of Green Revolution , these have not been sufficient in making dent an the problem of slow growth of agricultural incaves in the economy. This implies that agricultural savings were not sufficient for even agricultural investment itself. This necessitated for an inflow of income into the agricultural sector from industrial sector apart from financial help on be half of the government to maintain the balance between the two sector, not only in factor and products market but also an intersectoral financial balance for the attainment of overall maximum possible development of Indian economy as a whole.

The demand for non - agricultural products by agriculture has risen at a faster rate than the demand for agricultural products by non -agriculture⁷ as evident from the analysis relating to their respective purchases between 1960 to 1989, agriculture has undergone the

process of modernisation. With the share of inputs such as fertilisers , pesticides and insecticides electricity and diesel oil in the total inputs used in agriculture having more than doubled .Within a period 14 years from 20 percent in 1973-74 to 45 percent in 1987 - 88 the growth of agricultural production , although appreciable in itself , is yet less than that needed for meeting the economy's requirement of food grains and raw materials . On the other hand though industrial production has not maintained an accelerated growth rate, it has not fallen short of aggregate demand. As a matter of fact this higher percentage of modern inputs injected into agriculture has been made passible by government intervention in terms of a positive price policy for agricultural commodities. Besides this supporting prices by state for encouraging agricultural investment and hence production, concessional electricity rates and water rates have also been provided & farmer, above all the single most important factor in the direction of agricultural and hence rural welfare has been the introduction and implication of policy relating to fertilizer subsidy. However , this has not shown itself in a proportionate betterment of the agricultural performance, compared to a more than 100 percent increase in the utilisation of modern inputs in agriculture between 1973-74 to 1987-88 alongside an increase of 35 percent in the grass irrigated area between the same period, the value added from agriculture registered a rise of only 25 percent in this period , the value of output from agriculture per unit of modern input decreased at constant prices (1970-71) from Rs. 22 in 1973-74 & a little less than Rs 7 in 1987-88. At the same time, during 1974-75 to 1989-90, prices paid by agriculture for intermediate products from the non - agricultural sector rose by 224 percent . While those received by agriculture for all its sales to non - farm sector as final consumption good as well as input use also rose but at a much lower order (105 percent) as compared to that of its purchases the above said period was characterised by unfavourable terms of trade for agriculture which itself means that the prices paid by the farmers would be obviously much more than that of the prices received by the agriculturists from its sales to non - farm sector. During the period 1959-60 to 1973-74 when terms of trade went in favour of agriculture, prices received by agriculture had risen by more or less the same order is 109 percent, while however the prices paid for industrial

inputs showed an increase of a lesser order of 63 percent. The deterioration in the terms of trade started thereafter in the sense that agricultural party index went against agriculture due lower means of agricultural prices relative to prices of industrial goods and services. The unfavourable terms of trade for agriculture since 1973-74 is perhaps more a reflection of an accelerated demand for modern inputs by farmers than of accelerated agricultural supplies. The phenomenal increase in the consumption of modern inputs by agriculture pushed up the prices of there inputs without commensurate increase in agricultural production.

To put the above conclusions briefly, we can say that both sectors have recorded considerable expansion in production, industrial production growing faster than agricultural production. Industrial production is well correlated with agricultural production. There have been no marked changes in the sectorial distribution of work force corresponding to the visible decline in the share of agriculture in the Gross Domestic Product exchange of products between the sectors has gained momentum during the period of post Green Revolution. Both sales and purchase of agriculture vis-a-vis non agriculture have grown faster during the post agricultural revolution period compared to the earlier period 1951-64. The rate of growth of sales was faster than that of purchases in the earlier period, but in the latter period purchases grow faster than sales. This was basically due to purchases of modern inputs by agriculturist for a significantly high prices and that it was not sufficiently compensated by higher agricultural supplies. It can be proved by the fact that purchases of modern inputs by agriculturist for intermediate use quadrupled themselves during 1965-66 to 1990-91.

Productivity of modern inputs used in agricultural production has shown a marked decline. This is evident from the fact that the prices paid by farmers was much higher than the prices received by the farmers which means that the increase in agricultural investment especially in the farm of modern inputs purchases has not resulted in an equivalent increase in its productivity. There have been three phases in the long term trend in the net barter terms of trade. It remained relatively stable during 1951-52 to 1964-65. This period

was character used by highest growth rate both for agriculture and industry. Thereafter during the period 1964-66 to 1977-78 the terms of trade improved considerably in favour of agriculture. But since 1978-79 it started deteriorating. Income terms of trade which have been improving for agriculture since 1951-52, improved to the maximum level in 1973-74. That is why it is concluded that though income terms of trade also improved in 1978-79 if compared to 1960-61 but deteriorated with reference to 1973-74. The growth rate of household sector's savings was highest when the growth rates of agriculture and industry were highest. Between the deteriorating and improving phases in terms of trade, household sector's saving as a ratio of GDP or its rate of growth did not varied significantly.

Falling agricultural prices, make the terms of trade favourable to industry due to falling prices of raw materials, while food prices are independent variable to industry. During period of falling General price level, the real manufacturing prices are higher and so the industrial sector gains (ie during 1951-52 to 1964-65). But as the industrial gain is more concerned with price level of raw material, falling raw material prices is the main factor behind falling agricultural prices in general. Thus the loss here is a loss to raw material farmer and not to the food farmer. Farther the food prices have shown lesser volatility than raw material prices during fall prices. Industrial wages are more or less directly proportional to Food price. However, Food prices have been relatively in elastic than raw material prices during the period of falling General prices level. But of course net result is a fall in the rate of increase in Agriculture prices as a whole. This implies that during period of falling prices industry would gain greatly due to relative volatility of raw material prices. If industrial prices in this phase rise relatively, agriculture may continue to have increasing demand in the raw material sector while the food sector being mainly non-commercial, but having a positive various elasticity, doesn't have lose much. This implies that the net gain in the falling price periods will be positive relative to periods of rising general price level. During rising General price level, it is again the raw material prices which is more sensitive going

upward and pushes up the cost of industrial production. Raw material prices in both cases (During falling as well as rising prices) tend to go downward and upward in a more responsive manner respectively and push down or push up the cost of industrial production as the case may be, at a much faster rate. In case of falling prices the effect of food prices on industrial wages is indirect in the sense that real wages increase automatically even if money wages are not increased, due to higher purchasing power. But in case of rising prices, the food price influences the real wage negatively as opposed to the positive effect in case of falling prices. This forces the industrial workers to demand for a higher money wage so as to compensate for the inflationary tendencies. This, aggregatively both the prices (raw material prices and food prices) push up the cost of production upwards to a greater extent. The share of raw material prices being higher than that of food prices in pushing it up.

Terms of trade seem to have nothing to do with output responses. It is clear from the above conclusions that terms of trade, whether income terms of trade or not, barter terms of trade only explain a relatively money gain to agriculture or industry. It doesn't explain that there are any output responses in accordance with the terms of trade. Various statistical analyses have shown that if there is any output response, it is inter-sectorial rather than intra-sectorial. This means that favourable terms of trade for agriculture may be associated with same increase in acreage for traditional crops to highly payable commercial crops or foreign exchange earning crops but not from agriculture to industry or the other way round. The agriculturists are worried not about the agriculture parity prices relative to industries but with their own particular crop prices with other crops which are agriculturally competitive but it is clear that they are not in competition with industrial prices. Thus a favourable terms of trade for agriculture may not have any special effect more than a diversion of acreage from one crop to another.

Our research relating to relative prices of both the sectors in our economy shows that a continued period of higher relative price of agriculture has not been associated with rising productivity. Prof. Brahmananda also found that during the last two decades of planning with

continued increase in the price of both the sector's commodities, agricultural prices has risen at a faster rate. In spite of a higher increase in agricultural prices, as a result of increase in factor quantity, the growth of gross output has not shown any matchable expansion. According to Brahmananda, factor quantity has increased but the growth of gross output is stagnating. Though there has been a marginal rise in factor quantity of and land, but it has not given any proportional return. A disproportionate growth of capital stock has led to a non-proportional return. This non-proportionality of growth of capital stock with corresponding growth of output is also visible in industrial sector⁸. But the non-proportionality of output is not to the extent as it is in Agricultural and allied sectors. We finally conclude that a continuous increase in prices explains the reality that this has been visible due to rising input cash and falling output along with increase in the use of technologically advanced inputs. This further implies that there is an increase relationship between price and agricultural output in India. The agricultural supply has been expanding at low level prices and it has been slackening at higher prices.

As far as intersectorial adjustment relating to output and input is conceived, the industrial sector which is predominantly the consumer of agricultural output have to readjust and change its production pattern in order to include in its product mix resource such as fertilisers, pesticides, improved machinery and implements. This readjustment would reinforce the overall growth of the economy. The rapid progress in agriculture during 1970 to 1990 has resulted in the expansion of the industries which manufacture agricultural input and industries involved in the processing and preservation of products related to agriculture, horticulture, forest etc. The economy has thus begun to develop intersectorally and reinforced the process of overall growth of the economy inputs. With the increase in irrigated area, consumption of fertilizers, pesticides etc. has increasingly augmented industries which supplies its output to agriculture for its use as input. This interrelation between agriculture and industry has strengthened.

Finally we analysed the resource flows between agriculture and manufacturing sectors in India, industry and agriculture interact either in mutual sterilization pattern or in mutual

sterilization. The inter industry transactions show that manufacturing and other sectors are more dependent on agriculture as compared to dependence of agriculture on manufacturing and other sectors. But when we compare the extent of dependence of manufacturing and other sector on agriculture among themselves, we conclude that the dependence of manufacturing on agriculture is more as compared to the dependence of other sectors on agriculture. A comparison of inter industry resource flows between manufacturing and other sectors shows that the degree of interdependence between them is more or less the same because the flow of output from manufacturing to others is around 3.2 percent and that of other sectors to manufacturing is negligibly more than that which does not exceed 33 percent of the total output of other sectors.

The above conclusions regarding inter industry transactions are related to the proportion of total output of a sector flowing to another either for intermediate use (as input supply) or for final consumption once again it may be pointed out that in the above context manufacturing and other sectors, both have shown much more dependence upon agriculture than that of agriculture on either of these sectors. Thereafter we see the interdependence between these sectors in terms of flow of resources only as input supply. It is concluded that manufacturing is again more dependent upon agriculture for its input resources than that of agriculture on manufacturing. As far as the input supply relationship between agriculture and other sectors is concerned, agriculture is much more dependent on other sector for its inputs than that other sectors' input dependence upon agriculture. Other sectors supply more than 45 percent of total input use in agriculture whereas agriculture supplies merely around 20 percent of total input use in other sectors. As far as inter industry input resource flow between manufacturing and other sectors is concerned our analysis concludes that their mutual interdependence with respect to input supply is more or less the same as was the case regarding flow of output. As has been said earlier that 1960-61 to 1970-71 was a period of favourable terms of trade for agriculture whereas 1973-84 to 1983-84 was a period of unfavourable terms of trade for agriculture. Now one

would like to know what as the basic cause of unfavourable terms of trade for agriculture since 1973-74. For this we may go back to the period of favourable terms of trade is 1960-70. In this period prices received by agriculture had risen by more or less the same order as was during the period of unfavourable terms of trade i.e. around 100 percent but the prices paid by farmers for industrial input showed an increase of a lesser order of around 20 percent as against much higher order of around 200 percent in the period 1973-74-83-84 (period of unfavourable terms of trade). This implies that the deterioration in the terms of trade since 1970-71 specifically during the period 1973-74 to 1984-85 was mainly due to an accelerated demand for modern inputs by agriculture. In other words it leads us to conclude that unfavourable terms of trade in India happens to be more a reflection of soaring demand for technologically advanced inputs from non-agriculture sector than of plentiful agricultural supplies to non-farm sector. Finally it is suggested for policy purpose that in order to improve the terms of trade in favour of agriculture, policy makers and concerned researchers should concentrate more towards demand side than that of supply side (flow of output to non-farm sector).

As it is clear that terms of trade may go against agriculture due to three factors. Firstly if it is heavily investing in the purchase of inputs, Secondly large volume of supply of agricultural output and thirdly a combination of both may progressively keep the terms of trade unfavourable terms of trade, so it can be concluded.

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